DEC 0 7 2001 PATENT & TRADEMARK OFFICE

10009368 .060302

JC07 Rec'd PCT/PTO 07 DEC 2001

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
n/a 10/009368	PCT/US00/15624	108-085USAC00

21. [X] The following fees are submitted:

	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1040.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$890.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 710.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [X] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$ 130.00	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	$	
Total claims	13 - 20 =		x **$18.00**	$ 0.00	
Independent claims	1 - 3 =		x **$84.00**	$ 0.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$280.00**	$	

TOTAL OF ABOVE CALCULATIONS =	$ 840.00		
[ ] Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. +	$		
SUBTOTAL =	$ 840.00		
Processing fee of **$130.00** for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)).	$		
TOTAL NATIONAL FEE =	$ 840.00		
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +	$		
TOTAL FEES ENCLOSED =	$ 840.00		
	Amount to be refunded:	$	
	charged:	$	

a. [X] A check in the amount of $ 840.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. ____________ in the amount of $ __________ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 16-1340. A duplicate copy of this sheet is enclosed.

d. [ ] Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Thomas J. Perkowski, Esq.
Thomas J. Perkowski, ESq.,P.C.
Soundview Plaza
1266 East Main Street
Stamford, CT 06906
203-357-1950

[signature]
SIGNATURE

Thomas J. Perkowski
NAME

33,134
REGISTRATION NUMBER

FORM PTO-1390 (REV. 9-2001) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY 'S DOCKET NUMBER 108-085USAC00

U.S. APPLICATION NO. (If known, see 37 CFR 1.5 n/a 10/009368

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US00/15624	07 June 2000	07 June 1999

TITLE OF INVENTION UNITARY PACKAGE IDENTIFICATION AND DIMENSIONING SYSTEM EMPLOYING LADAR-BASED SCANNING METHODS

APPLICANT(S) FOR DO/EO/US Zhu, Xiaoxun et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☒ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☒ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☐ Other items or information:

Attorney Docket No.: 108-085USAC00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re National Phase Entry Application into the United States (DO/EO/US) of:

Applicants	:	Zhu, Xiaoxun, et al.
Assignee	:	Metrologic Instruments, Inc.
International Application Serial No.	:	PCT/US00/15624
International Filing Date	:	June 7, 2000

Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

PRELIMINARY AMENDMENT

SIR:

Prior to examination of the present Application please amend the same as follows:

AMENDMENT THE SPECIFICATION

Please amend the Specification as follows:

After the TITLE OF INVENTION, please insert

--RELATED CASES

This Application is a National Phase Entry Application of International Application PCT/US00/15624 filed June 7, 2000, which is a Continuation-in-Part of the following U.S. Patent Application 09/327,756 filed June 7, 1999. --

AMENDMENT OF THE CLAIMS TO INVENTION:

Please delete Claims 1-4 without prejudice or disclaimer and amend Claims 5-9 as follows:

5. (Amended) An automated unitary-type package identification and measuring system [(i.e.] contained within a single housing [or enclosure), wherein], comprising:

a scanning subsystem [is used to read] for reading bar codes on packages entering the system so as to identify said scanned packages; and [, while]

a package dimensioning subsystem [is used to capture] for capturing information about the dimensions of each said package [prior to entry into the tunnel] as each said package is transported past said system.

6. (Amended) [An] The automated unitary-type package identification and measuring system of claim 5, wherein a Laser Detecting And Ranging (LADAR-based) scanning [methods are] method is embodied in said package dimensioning subsystem [used to capture] for capturing two-dimensional range data maps of the space above a conveyor [belt] structure along which said packages are transported, and a two-dimensional image contour tracing [methods are used] method is embodied in said package dimensioning subsystem [to extract] for extracting package dimension data [therefrom] from said two-dimensional range data maps.

7. (Amended) [A] The [unitary] automated unitary-type package identification and measuring system of claim 5, [in which the] wherein said scanning subsystem [can be] is realized using either a holographic scanning mechanism, a 1D or 2D camera system, or polygonal scanning mechanism.

8. (Amended) [A] The [unitary] automated unitary-type package identification and measuring system of claim 5, [in which] wherein the [package] velocity of each said package is computed by using a pair of amplitude modulated laser beams projected from said package dimensioning subsystem at different angular projections over [the] a conveyor [belt] structure along which said packages are transported.

9. (Amended) The [unitary] automated unitary-type package identification and measuring system of claim 8, [in which] wherein the amplitude modulated laser [scanning lasers] beams [having] have multiple wavelengths to [sensing] sense packages have a wide range of reflectivity characteristics.

Please delete claims 10-12 without prejudice or disclaimer and amend claims 13- as follows:

13. (Amended) [A] The automated unitary-type package identification and measuring system of claim 5, wherein [comprising] said [a] package dimensioning subsystem is realized as a LADAR-based package imaging detecting and dimensioning [unit (i.e.] subsystem[)] supported within said single housing above [the] a conveyor [belt] structure [of the] employed with said system.

14. (Amended) The automated package identification and measuring system of Claim 13, wherein [a] said LADAR-based imaging, detecting and dimensioning subsystem produces a synchronized

amplitude-modulated laser beam that is automatically scanned across the width of [the] said conveyor [belt] structure and, during each scan thereacross, detects and processes the reflected laser beam in order to capture a row of raw range [(and optionally reflection-intensity)] information that is referenced with respect to a polar-type coordinate system symbolically-embedded within [the] said LADAR-based imaging, detecting and dimensioning subsystem.

15. (Amended) The automated unitary-type package identification and measuring subsystem of Claim 14, wherein the rows of range data captured by [the] said LADAR-based imaging, detecting and dimensioning subsystem are continuously loaded into a preprocessing data buffer, one row at a time, and processed in real-time using window-type convolution kernals that smooth and edge-detect the raw range data and thus improve its quality for subsequent dimension data extraction operations.

16. (Amended) The automated unitary-type package identification and measuring subsystem of Claim 14, wherein [a] said LADAR-based imaging, detecting and dimensioning subsystem automatically subtracts detected background information (including noise) from the continuously updated range data map as to accommodate for changing environmental conditions and enable high system performance independent of background lighting conditions.

17. (Amended) The automated unitary-type package identification and measuring subsystem of Claim 14, wherein [a] said LADAR-based imaging, detecting and dimensioning subsystem automatically buffers consecutively captured rows of smoothed/edge-detected range data to provide a range data map of the space above [the] said conveyor [belt] structure, and employs two-dimensional image contour tracing techniques to detect image contours within the buffered range data map, indicative of packages being transported [through the laser scanning tunnel system] along said conveyor structure.

18. (Amended) The automated unitary-type package identification and measuring subsystem of Claim 17, wherein [a] said LADAR-based imaging, detecting and dimensioning subsystem automatically processes the indices (m,n) of the computed contours in order to detect vertices associated with polygonal-shaped objects extracted from the range data map, which are representative of packages [or like objects] being transported [through the laser scanning tunnel system] along said conveyor structure.

19. (Amended) The automated unitary-type package identification and measuring subsystem of Claim 18, wherein [the] said LADAR-based imaging, detecting and dimensioning subsystem automatically processes the m and n indices of the detected vertices associated with the computed

contours in order to detect candidates for corner points associated with the corners of a particular package being transported [through the laser scanning tunnel system] along said conveyor structure.

20. (Amended) The automated unitary-type package identification and measuring subsystem of Claim 19, wherein [the] said LADAR-based imaging, detecting and dimensioning subsystem automatically processes the m and n indices of detected corner point candidates in order to reduce those corner point candidates down to those most likely to be the corners of a regular-shaped polygonal object [(e.g. six sided box)].

Please delete claims 21-80 without prejudice or disclaimer.

REQUIREMENT UNDER 37 C.F.R. 1.121

As required under 37 C.F.R. 1.121, Applicants submit herewith a clean version of the first paragraph of Page 1:

RELATED CASES

This Application is a National Phase Entry Application of International Application PCT/US00/15624 filed June 7, 2000, which is a Continuation-in-Part of the following U.S. Patent Application 09/327,756 filed June 7, 1999.

Also required under 37 C.F.R. 1.121, Applicants submit the following set of claims, pursuant to the above Amendment.

5. An automated unitary-type package identification and measuring system contained within a single housing, comprising:

a scanning subsystem for reading bar codes on packages entering the system so as to identify said scanned packages; and

a package dimensioning subsystem for capturing information about the dimensions of each said package as each said package is transported past said system.

6. The automated unitary-type package identification and measuring system of claim 5, wherein a Laser Detecting And Ranging (LADAR-based) scanning method is embodied in said package dimensioning subsystem for capturing two-dimensional range data maps of the space above a conveyor structure along which said packages are transported, and a two-dimensional image contour tracing method is embodied in said package dimensioning subsystem for extracting package dimension data from said two-dimensional range data maps.

7. The automated unitary-type package identification and measuring system of claim 5, wherein said scanning subsystem is realized using either a holographic scanning mechanism, a 1D or 2D camera system, or polygonal scanning mechanism.

8. The automated unitary-type package identification and measuring system of claim 5, wherein the velocity of each said package is computed by using a pair of amplitude modulated laser beams projected from said package dimensioning subsystem at different angular projections over a conveyor structure along which said packages are transported.

9. The automated unitary-type package identification and measuring system of claim 8, wherein the amplitude modulated laser beams have multiple wavelengths to sense packages have a wide range of reflectivity characteristics.

13. The automated unitary-type package identification and measuring system of claim 5, wherein said package dimensioning subsystem is realized as a LADAR-based package imaging detecting and dimensioning supported within said single housing above a conveyor structure employed with said system.

14. The automated package identification and measuring system of Claim 13, wherein said LADAR-based imaging, detecting and dimensioning subsystem produces a synchronized amplitude-modulated laser beam that is automatically scanned across the width of said conveyor structure and, during each scan thereacross, detects and processes the reflected laser beam in order to capture a row of raw range information that is referenced with respect to a polar-type coordinate system symbolically-embedded within said LADAR-based imaging, detecting and dimensioning subsystem.

15. The automated unitary-type package identification and measuring subsystem of Claim 14, wherein the rows of range data captured by said LADAR-based imaging, detecting and dimensioning subsystem are continuously loaded into a preprocessing data buffer, one row at a time, and processed in real-time using window-type convolution kernals that smooth and edge-detect the raw range data and thus improve its quality for subsequent dimension data extraction operations.

16. The automated unitary-type package identification and measuring subsystem of Claim 14, wherein said LADAR-based imaging, detecting and dimensioning subsystem automatically subtracts detected background information (including noise) from the continuously updated range data map as to accommodate for changing environmental conditions and enable high system performance independent of background lighting conditions.

17. The automated unitary-type package identification and measuring subsystem of Claim 14, wherein said LADAR-based imaging, detecting and dimensioning subsystem automatically buffers consecutively captured rows of smoothed/edge-detected range data to provide a range data map of the space above said conveyor structure, and employs two-dimensional image contour tracing techniques to detect image contours within the buffered range data map, indicative of packages being transported along said conveyor structure.

18. The automated unitary-type package identification and measuring subsystem of Claim 17, wherein said LADAR-based imaging, detecting and dimensioning subsystem automatically processes the indices (m,n) of the computed contours in order to detect vertices associated with polygonal-shaped objects extracted from the range data map, which are representative of packages being transported along said conveyor structure.

19. The automated unitary-type package identification and measuring subsystem of Claim 18, wherein said LADAR-based imaging, detecting and dimensioning subsystem automatically processes the m and n indices of the detected vertices associated with the computed contours in order to detect candidates for corner points associated with the corners of a particular package being transported along said conveyor structure.

20. The automated unitary-type package identification and measuring subsystem of Claim 19, wherein said LADAR-based imaging, detecting and dimensioning subsystem automatically processes the m and n indices of detected corner point candidates in order to reduce those corner point candidates down to those most likely to be the corners of a regular-shaped polygonal object.

REMARKS

The present Application is being filed to prosecute subject matter disclosed in International Application Serial No. PCT/US00/15624 filed June 7, 2000.

Respectfully submitted,

Dated: December 7, 2001

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Attorney For Applicants
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Stamford, Connecticut 06902
203-357-1950
http://www.tjpatlaw.com

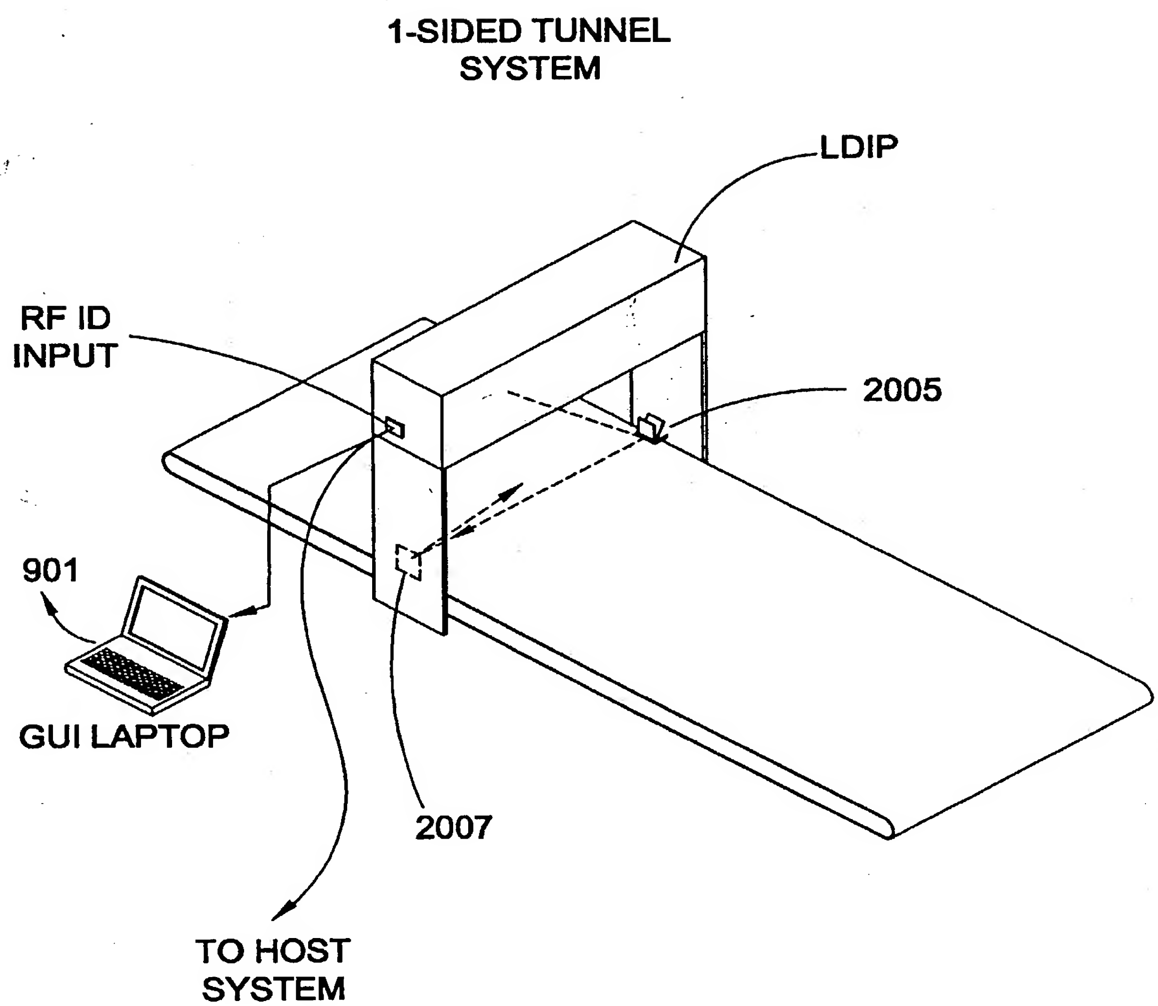
CERTIFICATE OF EXPRESS MAIL
UNDER 37 C.F.R. 1.10

I hereby certify that this correspondence is
being deposited with the United States Postal Service
on December 7, 2001
as Express Mail (No. EL725351072US)
in a postage prepaid envelope address to:

Commissioner of Patents
and Trademarks
P.O. Box 2327
Arlington, VA 22202

(alternative to the address set out in 37 C.F.R 1.1 and 37 C.F.R. 1.10;
Emergency Address for USPTO mail due to
November 16, 2001 suspension of "Express Mail" Service of USPS
for mail addressed to ZIP Codes 202xx through 205xx)

Mailer: Nancy Short
Dated: December 7, 2001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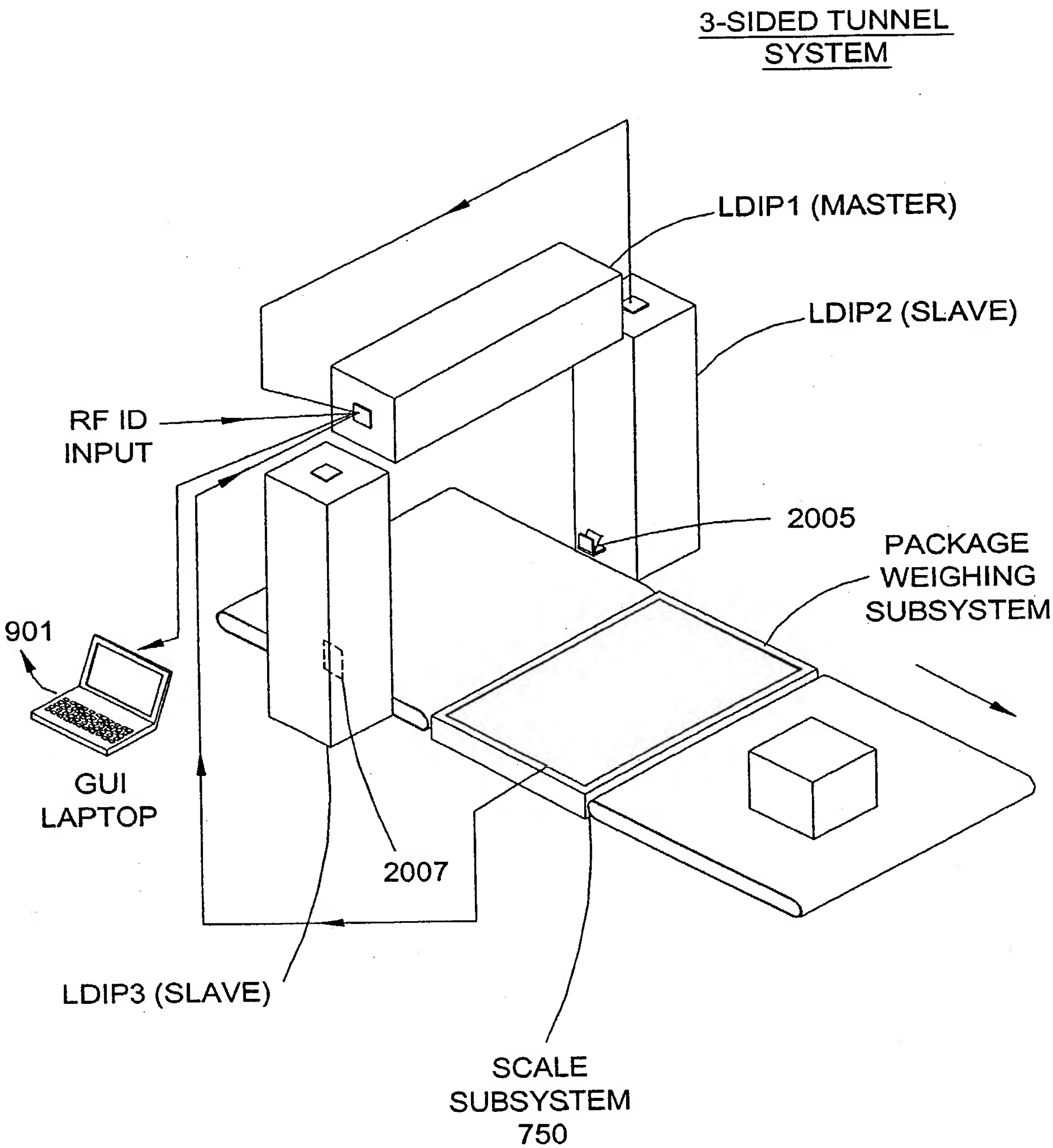
901
GUI LAPTOP
2007
TO HOST
SYSTEM

FIG. 1A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LDIP2 (SLAVE)
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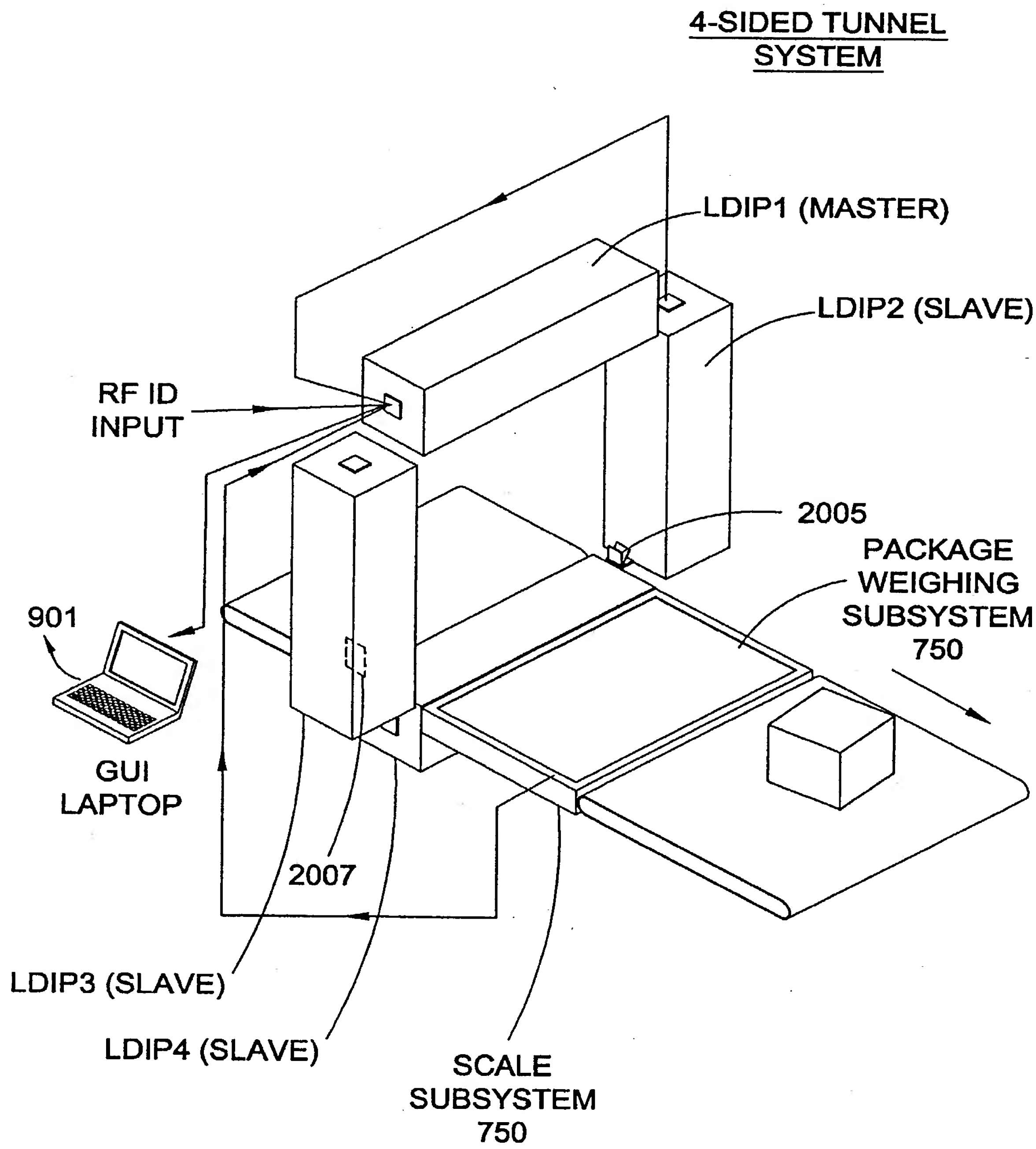
PACKAGE WEIGHING SUBSYSTEM
901
GUI LAPTOP
2007
LDIP3 (SLAVE)
SCALE SUBSYSTEM 750

FIG. 1B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LAPTOP
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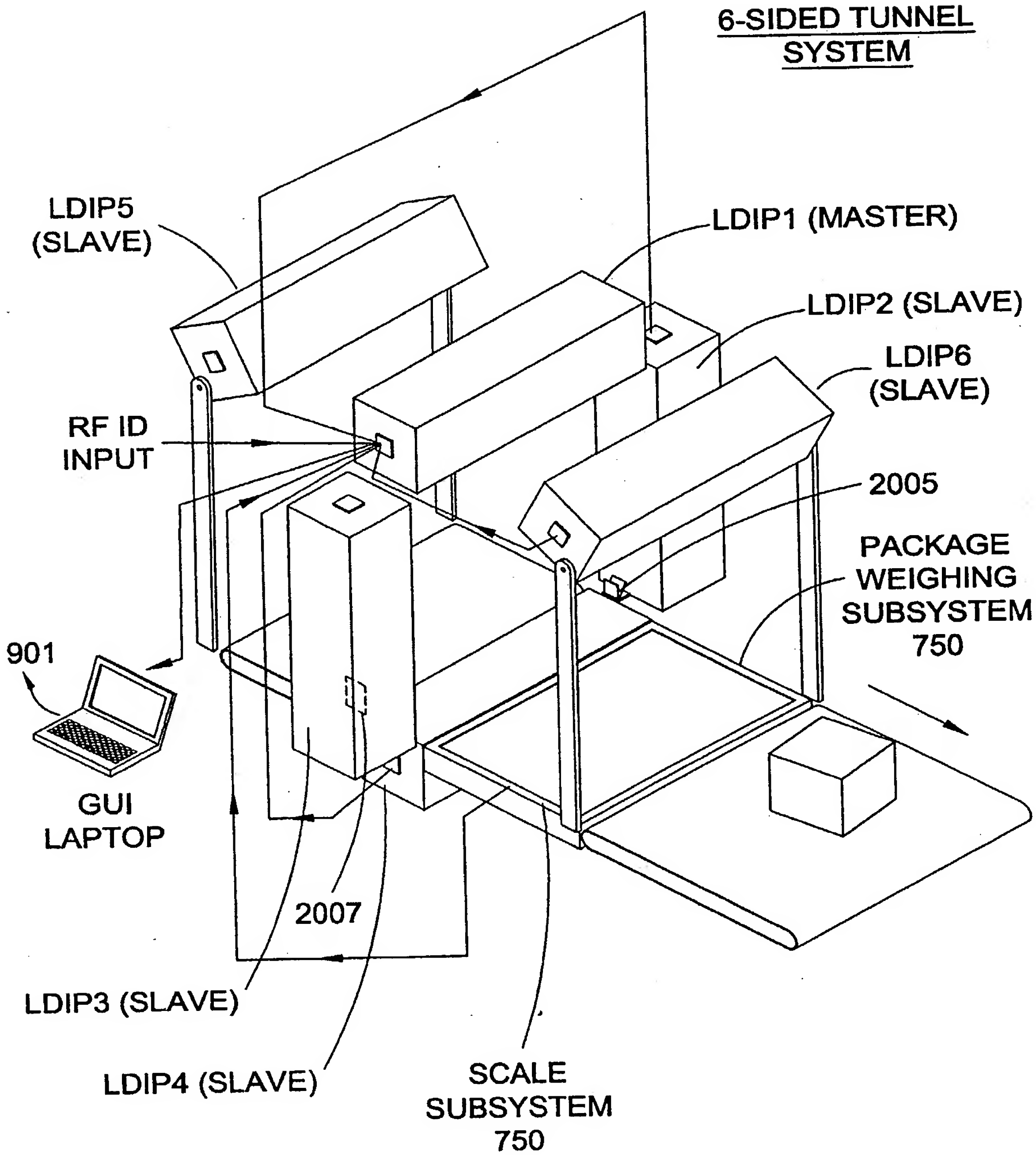
LDIP4 (SLAVE)
SCALE
SUBSYSTEM
750

FIG. 1C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LDIP2 (SLAVE)
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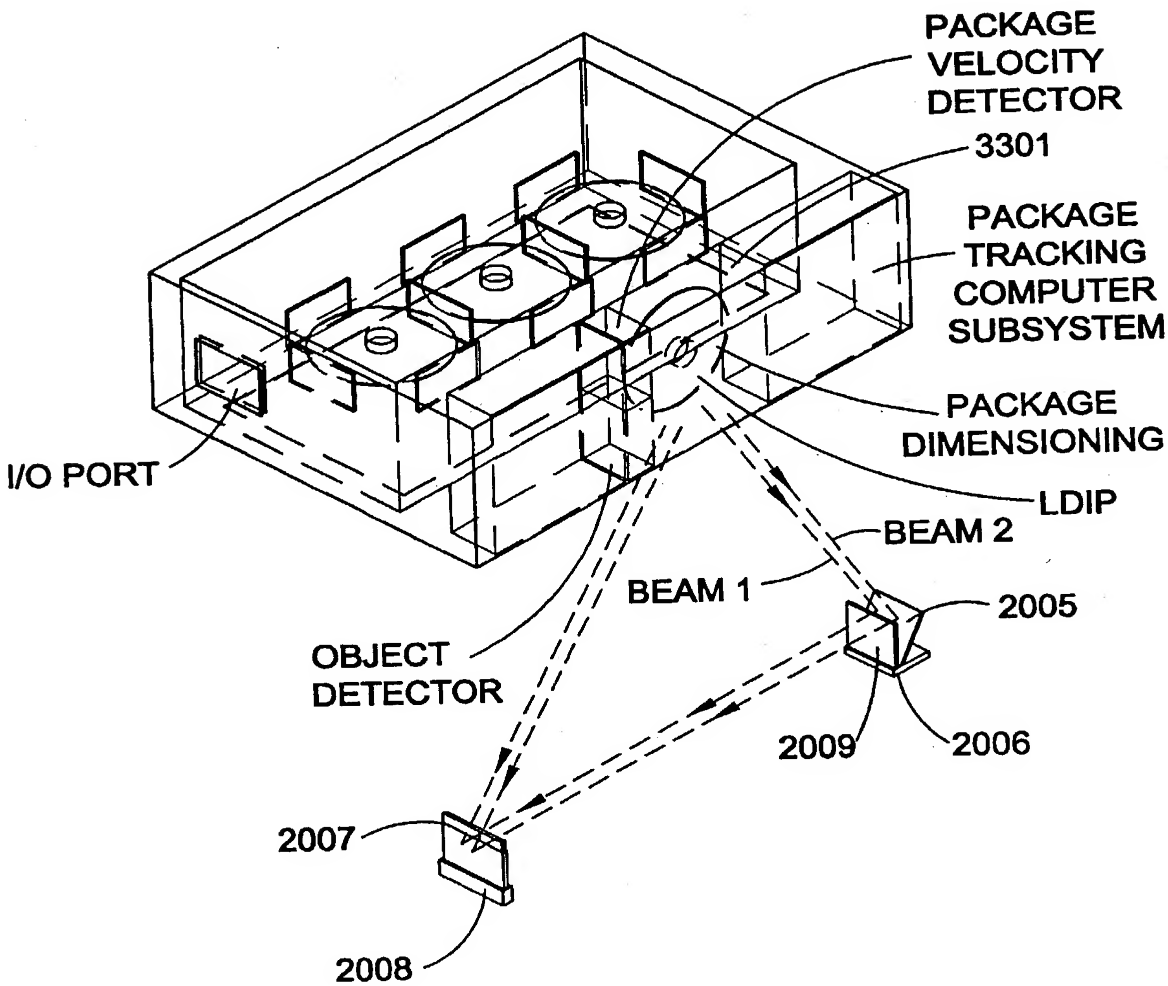
901
GUI LAPTOP
2007
LDIP3 (SLAVE)
LDIP4 (SLAVE)
SCALE SUBSYSTEM 750

FIG. 1D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DETECTOR
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PACKAGE
TRACKING
COMPUTER
SUBSYSTEM
PACKAGE
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LDIP
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BEAM 1
2005
I/O PORT
OBJECT
DETECTOR
2009
2006
2007
2008

FIG. 2A

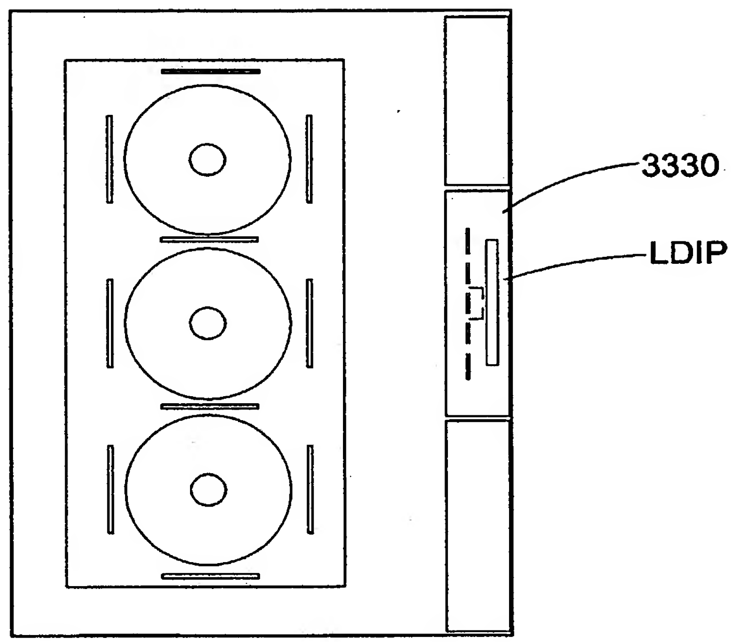

FIG. 2B

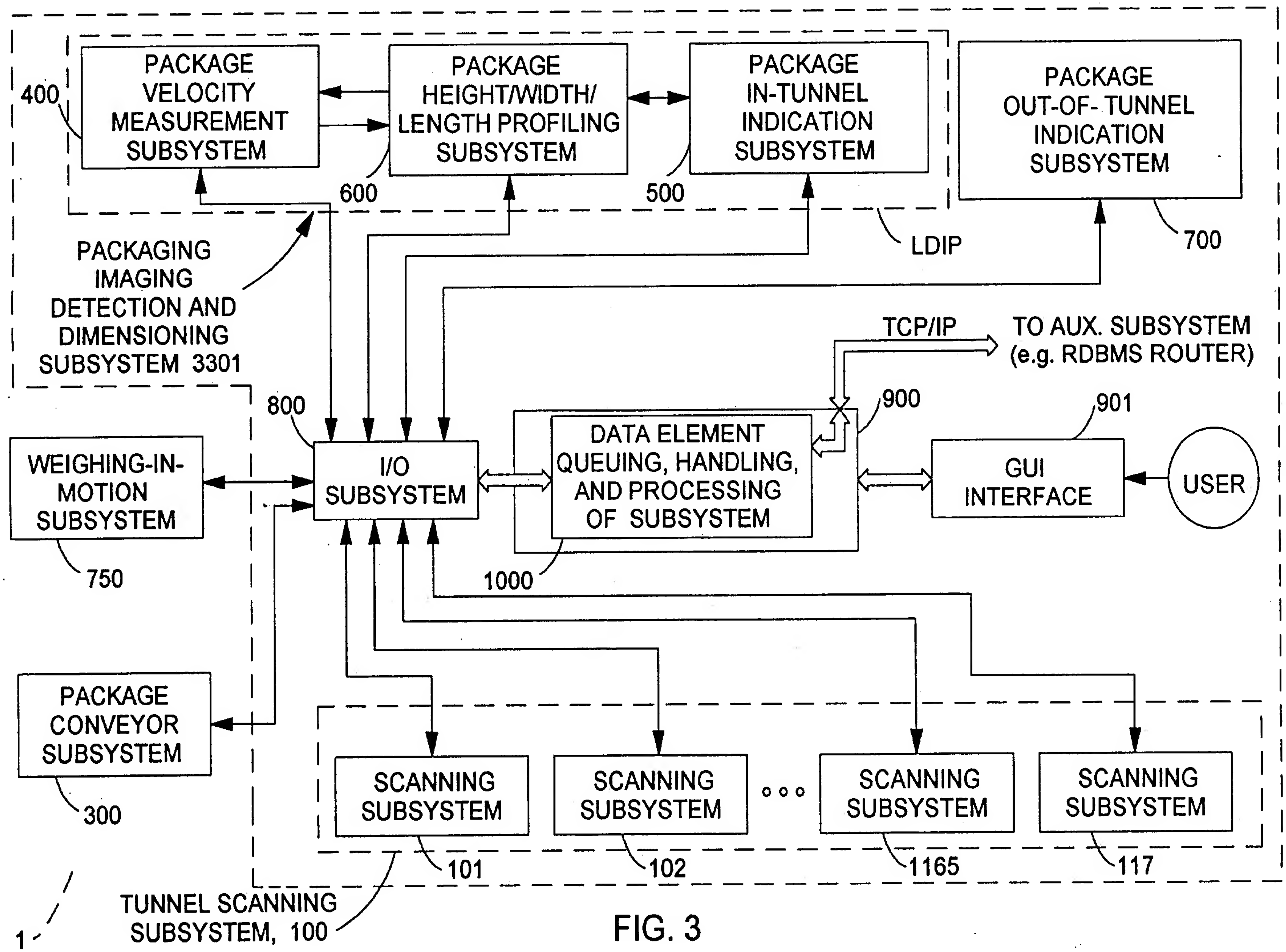

FIG. 3

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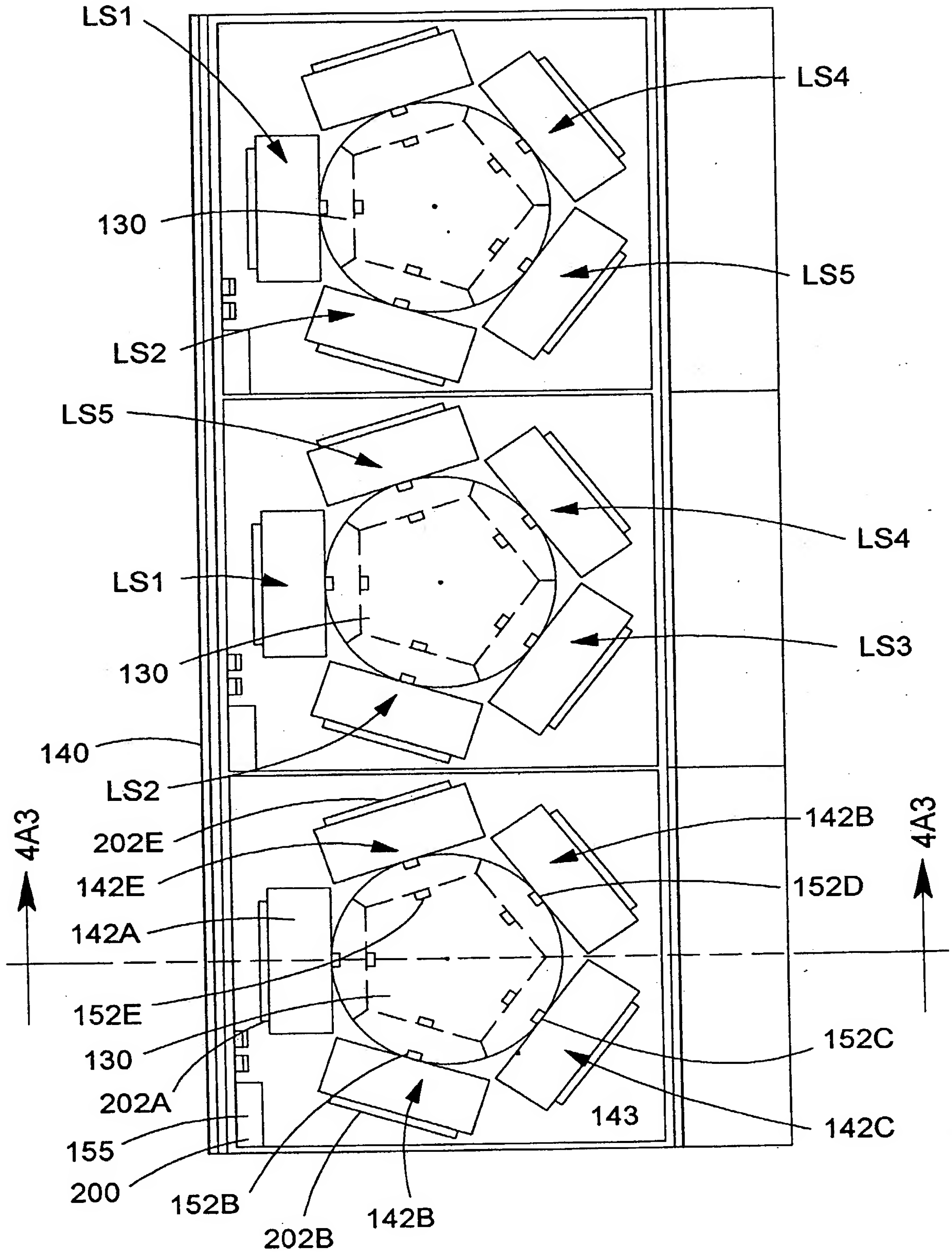
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LS4
130
LS5
LS2
LS5
LS4
LS1
130
LS3
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LS2
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202E
142B
4A3
142E
152D
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152E
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152C
202A
143
155
142C
200
152B
202B
142B

FIG. 4A1

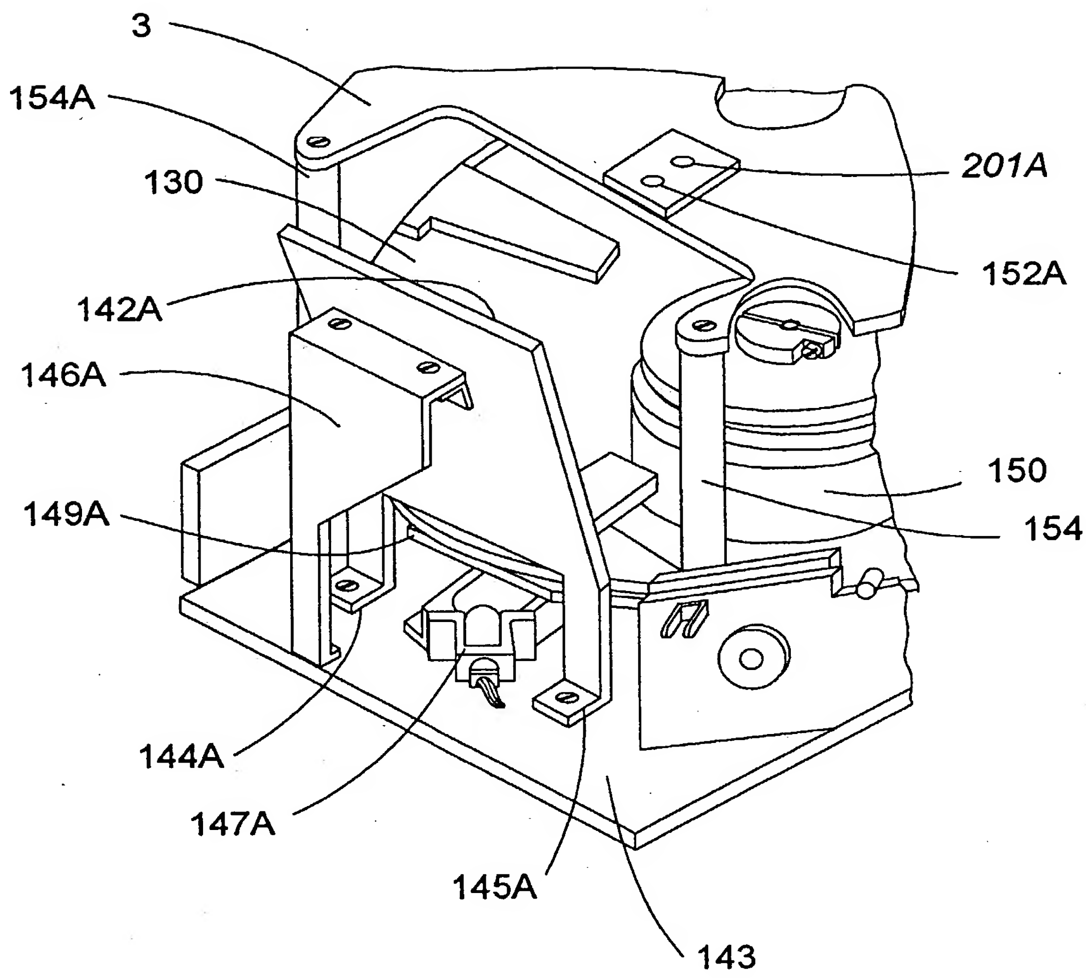
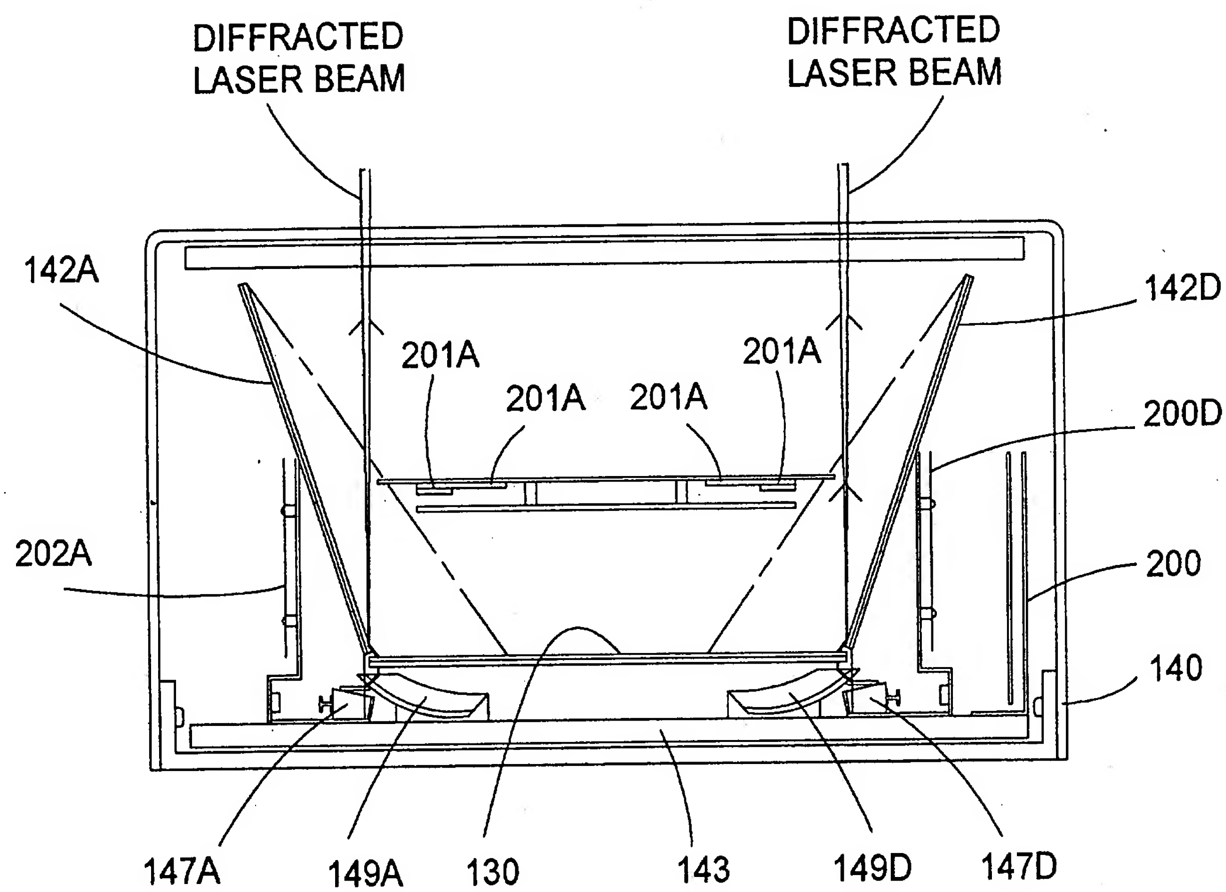


FIG. 4A2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LASER BEAM
DIFFRACTED
LASER BEAM
142A
142D
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202A
200
140
147A
149A
130
143
149D
147D

FIG. 4A3

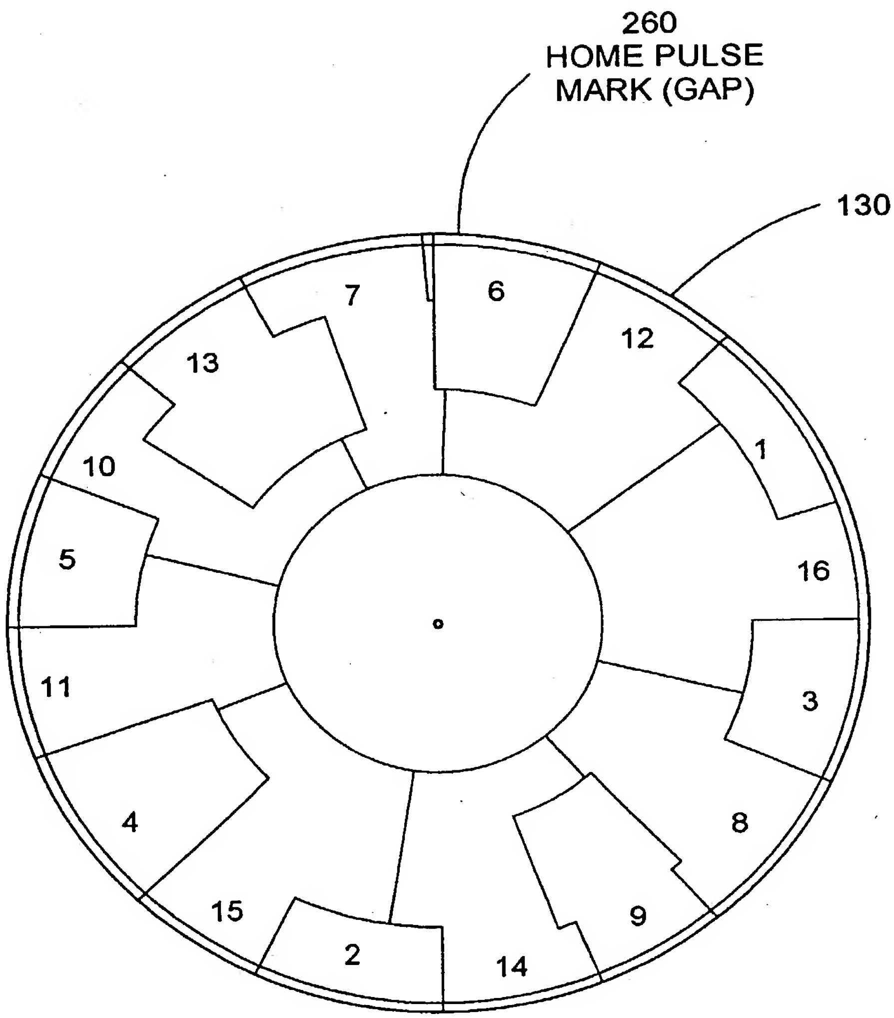
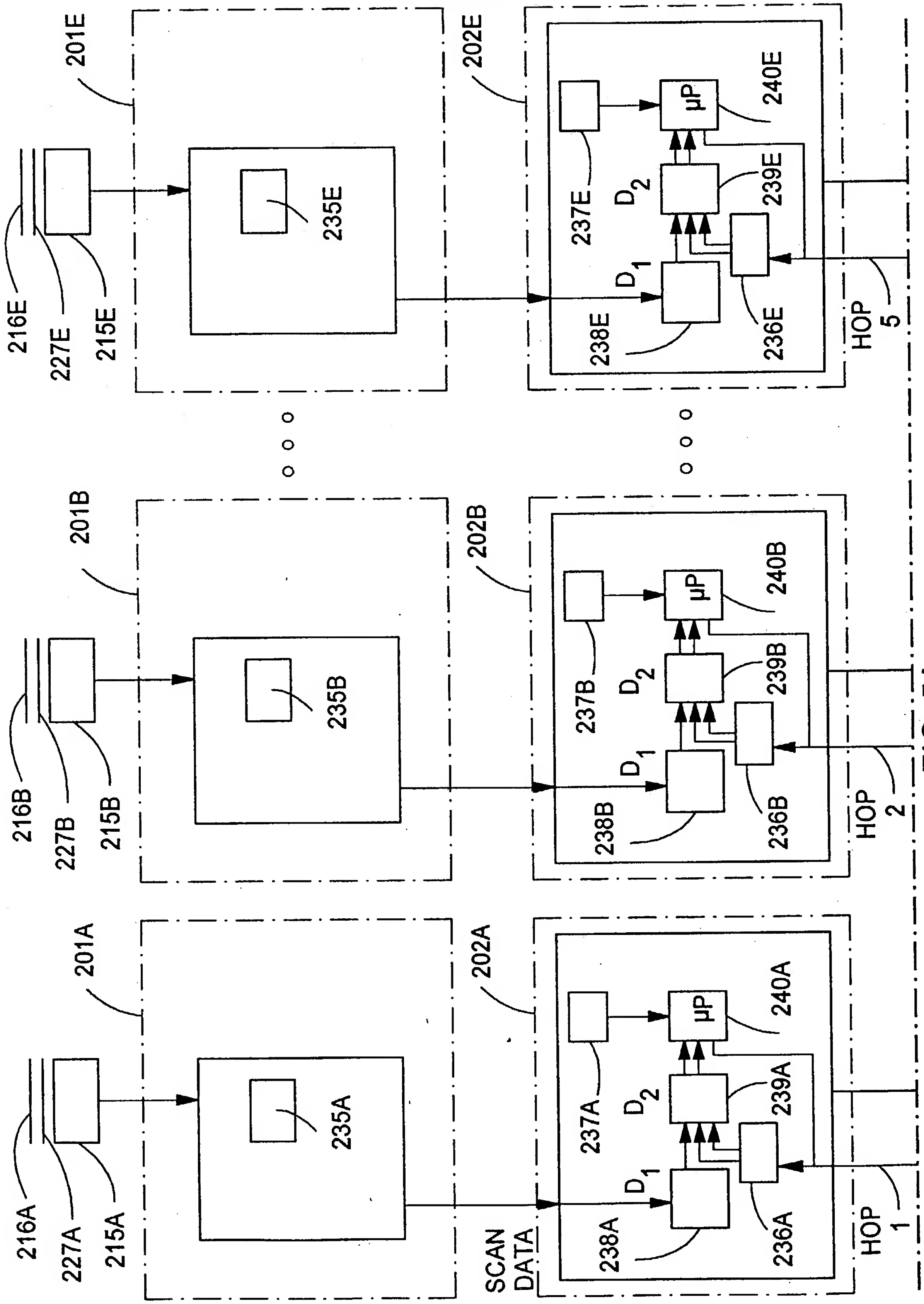


FIG. 4A4

FACET	DIFFRACTION FOCAL LENGTH (INCHES)	GEOMETRICAL FOCAL LENGTH (INCHES)	ANGLE A (DEGREE)	ANGLE B (DEGREE)	ANGLE OF DIFFRACTION (DEGREES)	ANGLE OF BEAM FROM VERTICAL (DEGREES)	SCAN ANGLE (DEGREES)	SCAN MULT. FACTOR (m)	ROTATION ANGLE (DEGREES)
1	49.57	49.76	45.9	61.06	28.94	-3.06	29.61	1.26	23.51
2	49.54	49.73	45.9	55.62	34.38	2.38	29.62	1.34	22.10
3	49.96	50.16	45.9	50.23	39.77	7.77	29.39	1.41	20.77
4	50.81	51.01	45.9	44.97	45.03	13.03	28.92	1.48	19.52
5	49.57	49.76	45.9	61.06	28.94	-3.06	29.61	1.26	23.51
6	49.54	49.73	45.9	55.62	34.38	2.38	29.62	1.34	22.10
7	49.96	50.16	45.9	50.23	39.77	7.77	29.39	1.41	20.77
8	50.81	51.01	45.9	44.97	45.03	13.03	28.92	1.48	19.52
9	59.06	59.38	45.9	60.56	29.44	-2.56	25.01	1.25	55.73
10	59.04	59.36	45.9	56.00	34.00	2.00	25.02	1.32	55.73
11	59.39	59.72	45.9	51.47	38.53	6.53	24.88	1.39	55.73
12	60.10	60.44	45.9	47.01	42.99	10.99	24.59	1.44	55.73
13	59.06	59.38	45.9	60.56	29.44	-2.56	25.01	1.25	55.89
14	59.04	59.36	45.9	56.00	34.00	2.00	25.02	1.32	55.89
15	59.39	59.72	45.9	51.47	38.53	6.53	24.88	1.39	55.89
16	60.10	60.44	45.9	47.01	42.99	10.99	24.59	1.44	55.89

FIG. 4A5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201A
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D_1
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237A
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238B
237B
239B
240B
236B
HOP 2
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202E
238E
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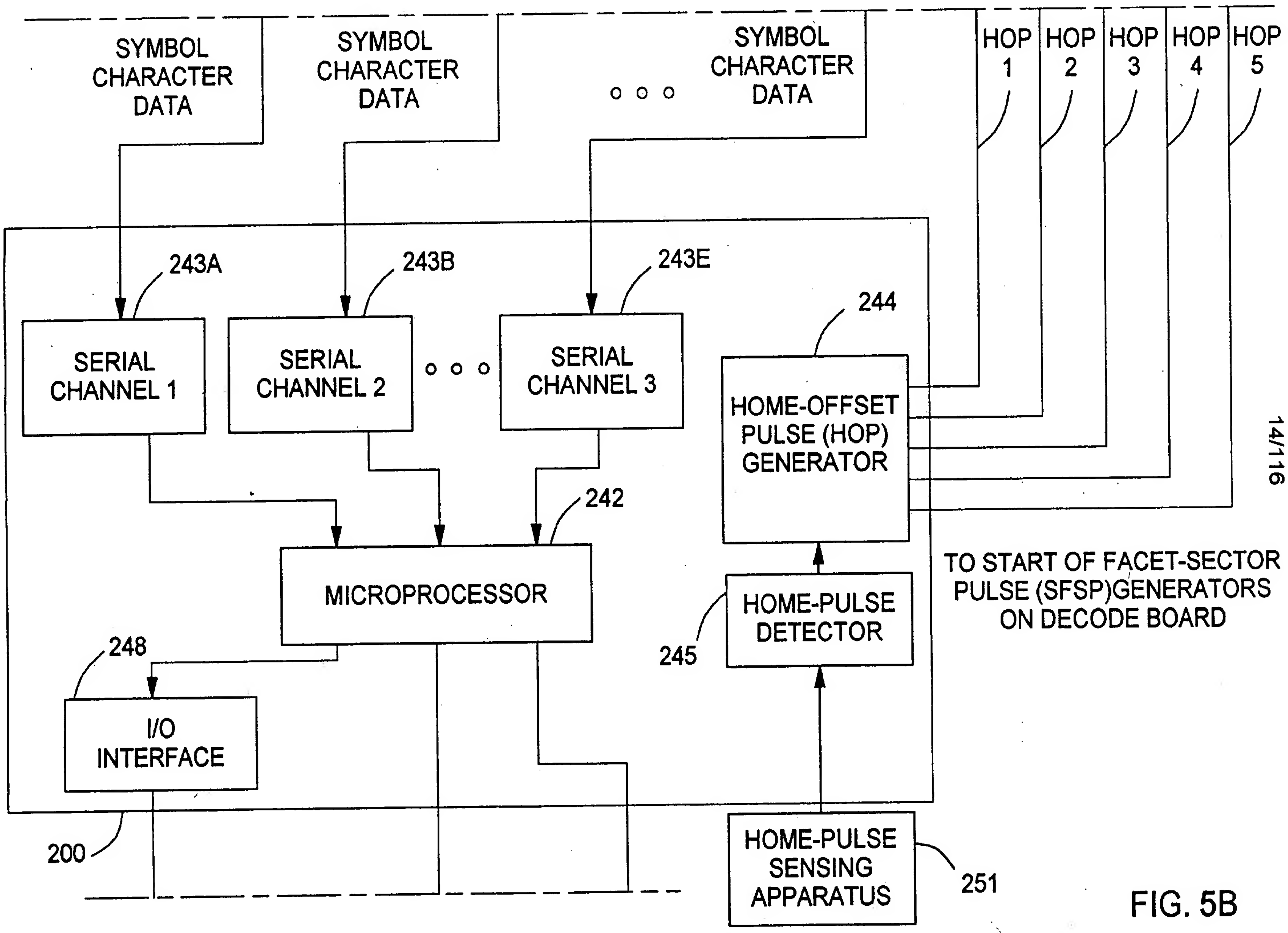
239E
240E
236E
HOP 5

FIG. 5A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HOP 1
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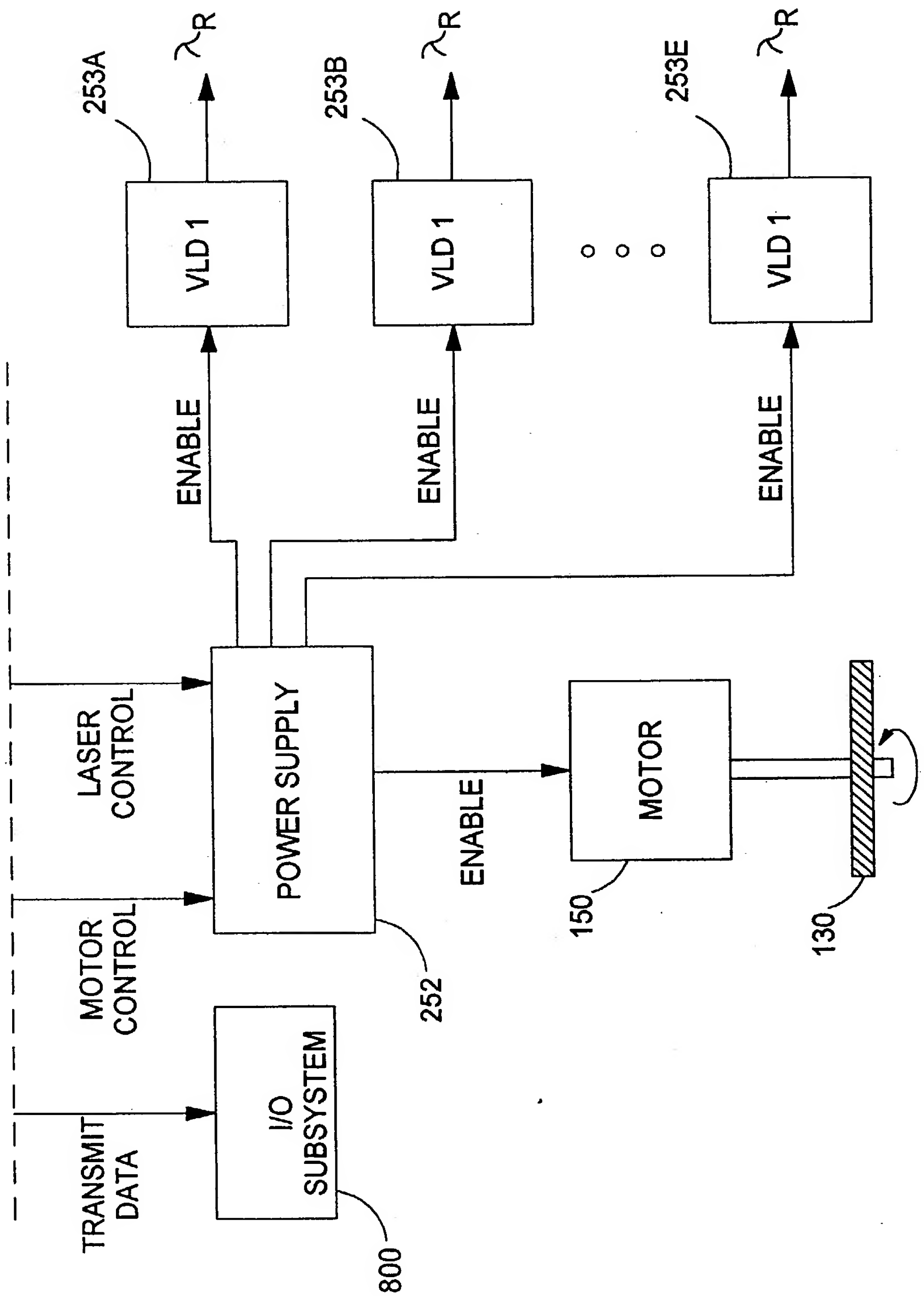
HOP 3
HOP 4
HOP 5
243A
243B
243E
244
SERIAL CHANNEL 1
SERIAL CHANNEL 2
SERIAL CHANNEL 3
HOME-OFFSET PULSE (HOP) GENERATOR
242
MICROPROCESSOR
TO START OF FACET-SECTOR PULSE (SFSP)GENERATORS ON DECODE BOARD
248
HOME-PULSE DETECTOR
245
I/O INTERFACE
200
HOME-PULSE SENSING APPARATUS
251

FIG. 5B



253A
λR
253B
λR
253E
λR
VLD 1
VLD 1
VLD 1
ENABLE
ENABLE
ENABLE
LASER CONTROL
POWER SUPPLY
MOTOR
ENABLE
ω
MOTOR CONTROL
150
130
252
TRANSMIT DATA
I/O SUBSYSTEM
800

FIG. 5C

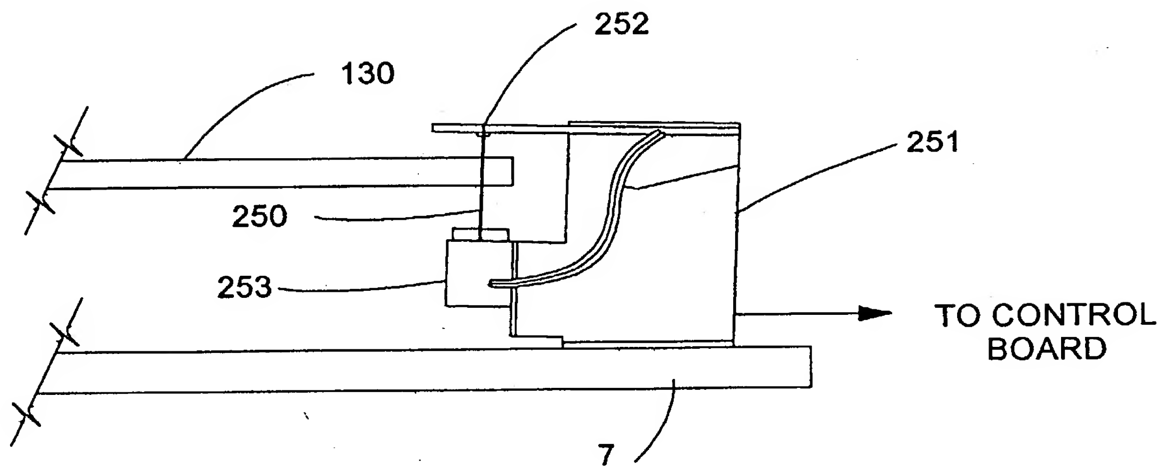


FIG. 6A

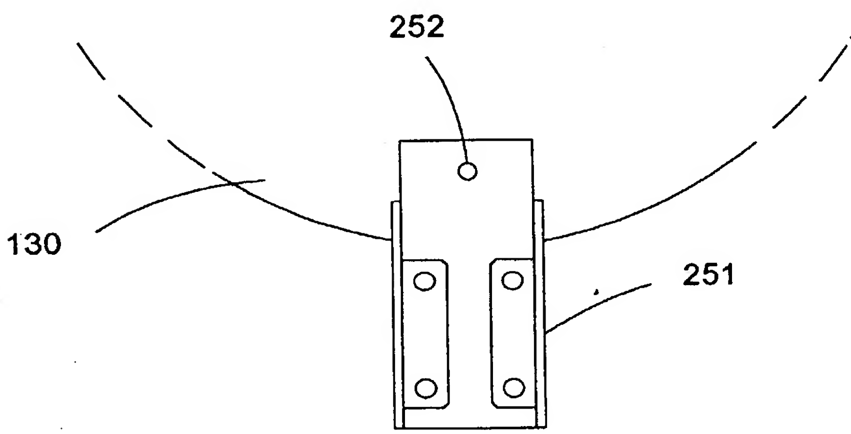


FIG. 6B

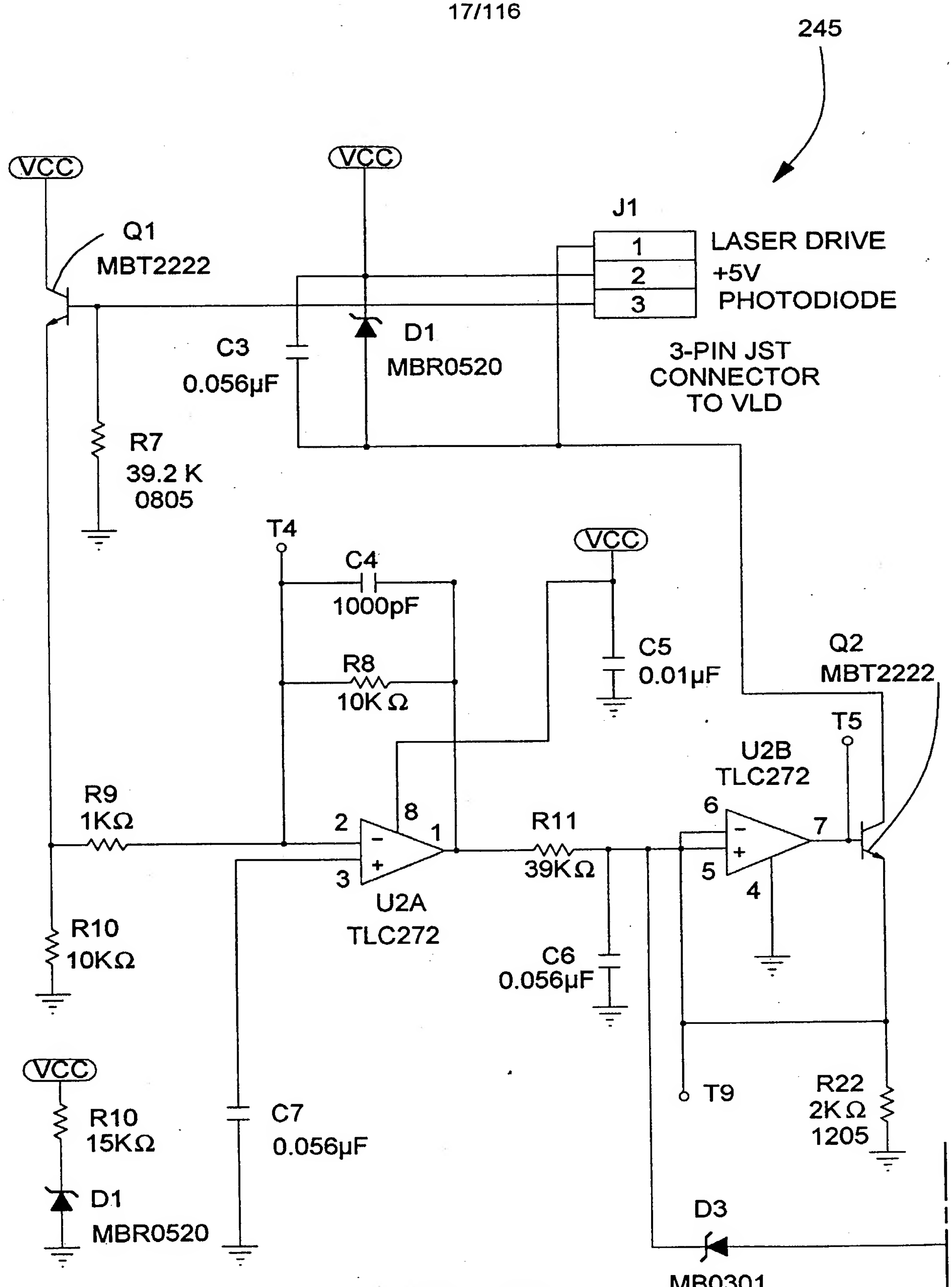

245
VCC
Q1
MBT2222
VCC
J1
1
2
3
LASER DRIVE
+5V
PHOTODIODE
C3
0.056µF
D1
MBR0520
3-PIN JST
CONNECTOR
TO VLD
R7
39.2 K
0805
T4
C4
1000pF
VCC
R8
10K Ω
C5
0.01µF
Q2
MBT2222
T5
U2B
TLC272
R9
1KΩ
2
8
1
3
U2A
TLC272
R11
39KΩ
6
7
5
4
R10
10KΩ
C6
0.056µF
VCC
R10
15KΩ
D1
MBR0520
C7
0.056µF
T9
R22
2K Ω
1205
D3
MB0301

FIG. 6C1

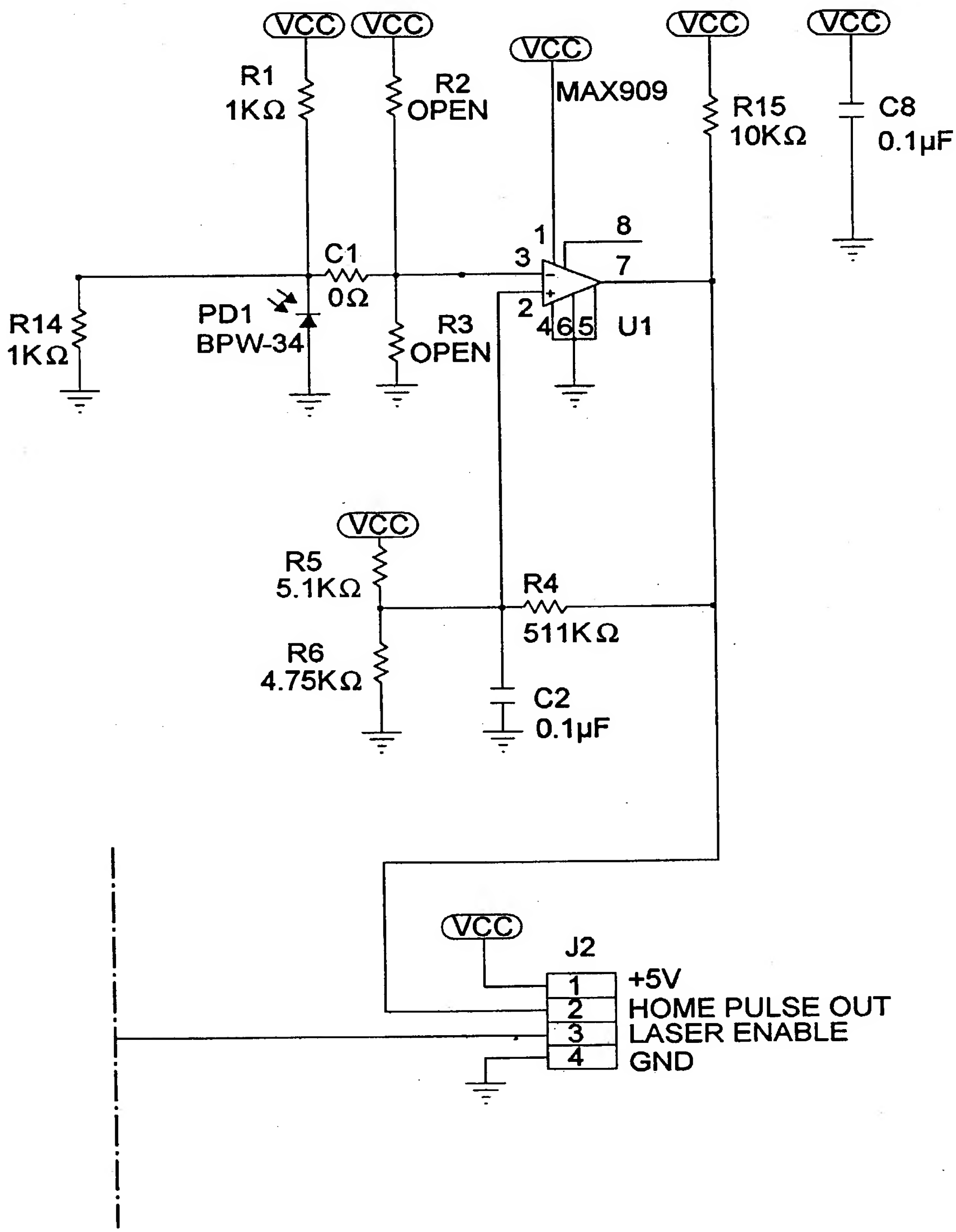
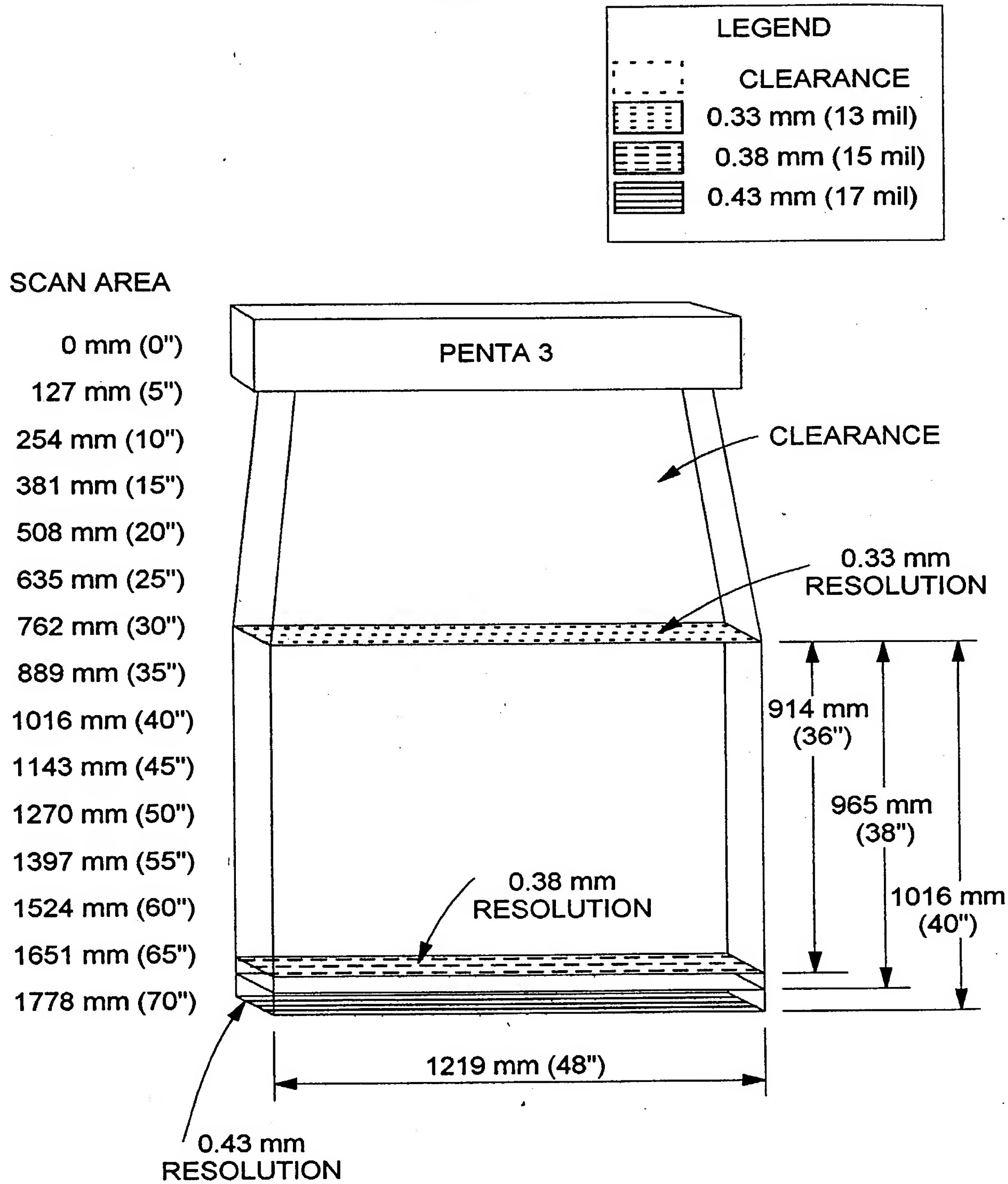

VCC
VCC
VCC
VCC
VCC
R1
1KΩ
R2
OPEN
MAX909
R15
10KΩ
C8
0.1μF
C1
0Ω
1
3
8
7
2
4 6 5
U1
R14
1KΩ
PD1
BPW-34
R3
OPEN
VCC
R5
5.1KΩ
R4
511KΩ
R6
4.75KΩ
C2
0.1μF
VCC
J2
1
2
3
4
+5V
HOME PULSE OUT
LASER ENABLE
GND

FIG. 6C2



LEGEND
CLEARANCE
0.33 mm (13 mil)
0.38 mm (15 mil)
0.43 mm (17 mil)
SCAN AREA
0 mm (0")
127 mm (5")
254 mm (10")
381 mm (15")
508 mm (20")
635 mm (25")
762 mm (30")
889 mm (35")
1016 mm (40")
1143 mm (45")
1270 mm (50")
1397 mm (55")
1524 mm (60")
1651 mm (65")
1778 mm (70")
PENTA 3
CLEARANCE
0.33 mm RESOLUTION
914 mm (36")
965 mm (38")
1016 mm (40")
0.38 mm RESOLUTION
1219 mm (48")
0.43 mm RESOLUTION

FIG. 7A

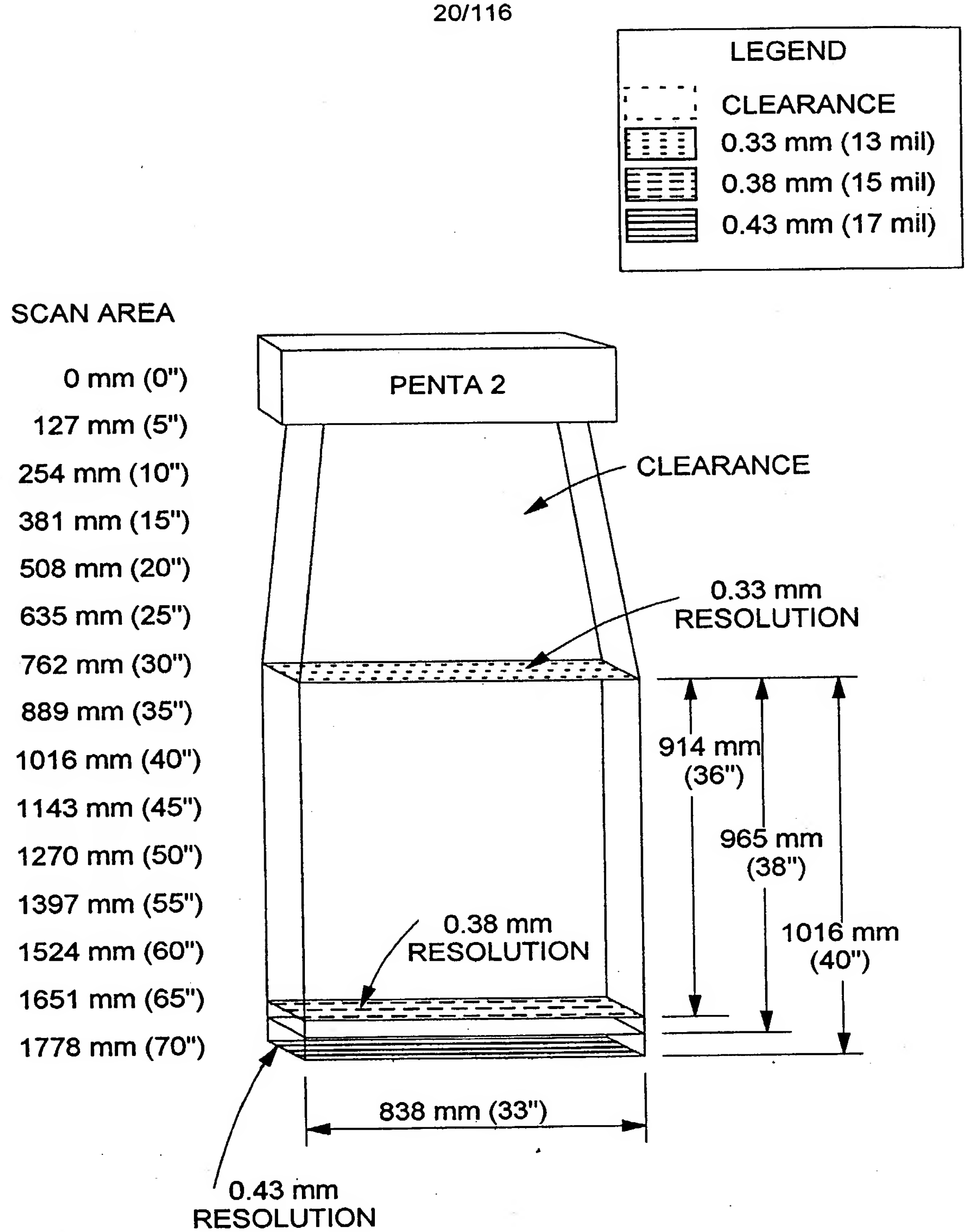

LEGEND
CLEARANCE
0.33 mm (13 mil)
0.38 mm (15 mil)
0.43 mm (17 mil)
SCAN AREA
0 mm (0")
127 mm (5")
254 mm (10")
381 mm (15")
508 mm (20")
635 mm (25")
762 mm (30")
889 mm (35")
1016 mm (40")
1143 mm (45")
1270 mm (50")
1397 mm (55")
1524 mm (60")
1651 mm (65")
1778 mm (70")
PENTA 2
CLEARANCE
0.33 mm RESOLUTION
914 mm (36")
965 mm (38")
1016 mm (40")
0.38 mm RESOLUTION
838 mm (33")
0.43 mm RESOLUTION

FIG. 7B

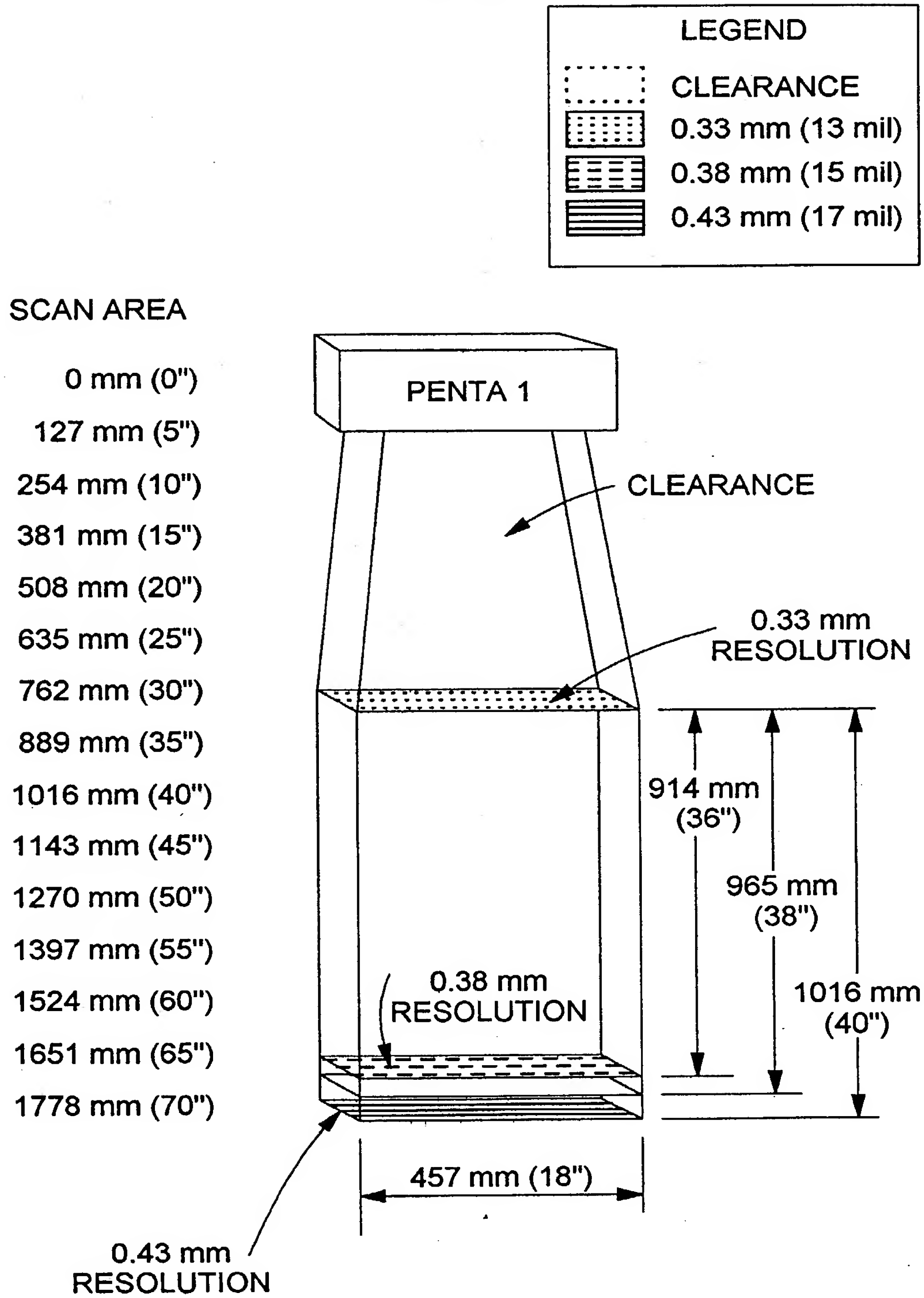

LEGEND
CLEARANCE
0.33 mm (13 mil)
0.38 mm (15 mil)
0.43 mm (17 mil)
SCAN AREA
0 mm (0")
127 mm (5")
254 mm (10")
381 mm (15")
508 mm (20")
635 mm (25")
762 mm (30")
889 mm (35")
1016 mm (40")
1143 mm (45")
1270 mm (50")
1397 mm (55")
1524 mm (60")
1651 mm (65")
1778 mm (70")
PENTA 1
CLEARANCE
0.33 mm RESOLUTION
914 mm (36")
965 mm (38")
1016 mm (40")
0.38 mm RESOLUTION
457 mm (18")
0.43 mm RESOLUTION

FIG. 7C

SPECIFICATIONS FOR PENTA 1, PENTA 2, PENTA 3 SCANNERS	
OPERATIONAL	
LIGHT SOURCE	5 VISIBLE LASER DIODES 858 + 5mm
LASER POWER	8.4mW (PEAK): LESS THAN 1 mW AVERAGE POWER
DEPTH OF SCAN FIELD	914mm (36") FOR 0.33 mm (13mil) BAR CODES 965mm (38") FOR 0.38 mm (15mil) BAR CODES 1,016mm (40") FOR 0.43 mm (17mil) BAR CODES
WIDTH OF SCAN FIELD	PENTA 1 : 457mm (18") PENTA 2 : 838mm (33") PENTA 3 : 1219mm (48")
SCAN SPEED	PENTA 1 : 6,930 SCAN LINES PER SECOND PENTA 2 : 13,860 SCAN LINES PER SECOND PENTA 3 : 20,790 SCAN LINES PER SECOND
SCAN PATTERN	OMNIDIRECTIONAL 5-SIDED PENTAGON SCAN PATTERN PENTA 1: 20 SCAN LINES REPEATED AT FOUR DISTANCES (80 TOTAL) PENTA 2: 40 SCAN LINES REPEATED AT FOUR DISTANCES (160 TOTAL) PENTA 3: 60 SCAN LINES REPEATED AT FOUR DISTANCES (240 TOTAL)
MINIMUM BAR WIDTH	0.33 mm (13mil)
DECODE CAPABILITY	AUTODISCRIMINATES ALL STANDARD BAR CODES
SYSTEM INTERFACES	RS 232. POINT TO POINT. RS422. LIGHT PEN EMULATION
PRINT CONTRAST	35% MINIMUM REFLECTANCE DIFFERENCE
NUMBER CHARACTERS READ	UP TO 60 DATA CHARACTERS. (MAXIMUM NUMBER WILL VARY BASED ON SYMBOLOGY AND DENSITY)
ASPECT RATIO	UP TO 2.6 TO 1

FIG. 8

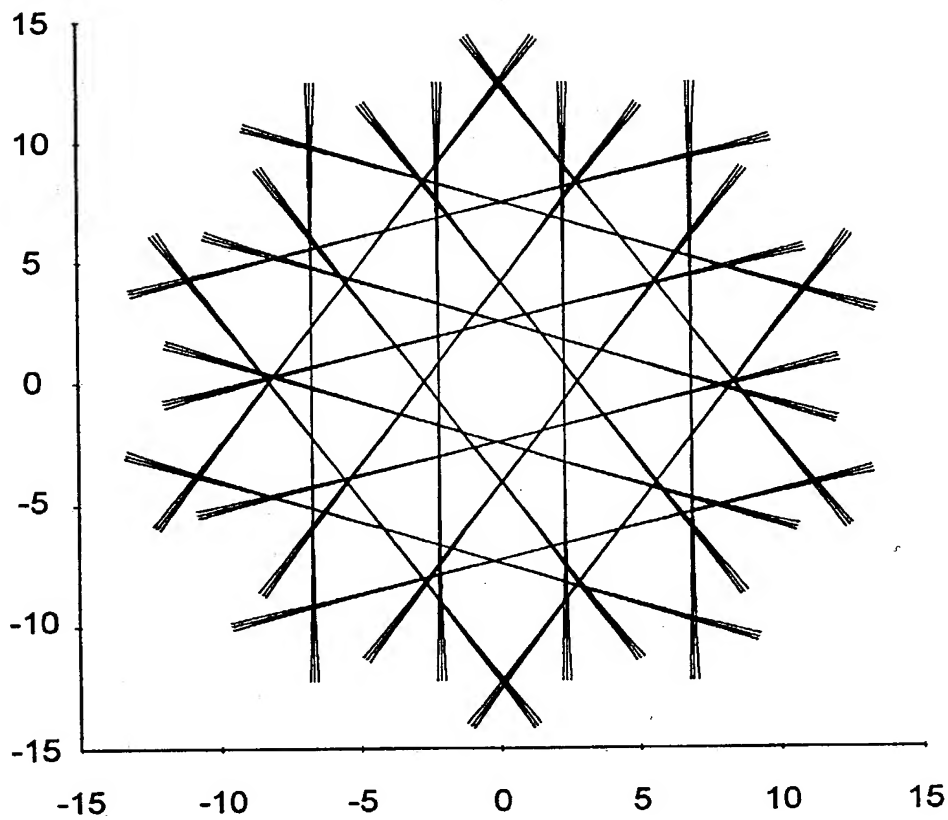


FIG. 9A

PENTA TRIPLE SCANNER FOCAL PLANE SCAN PATTERN

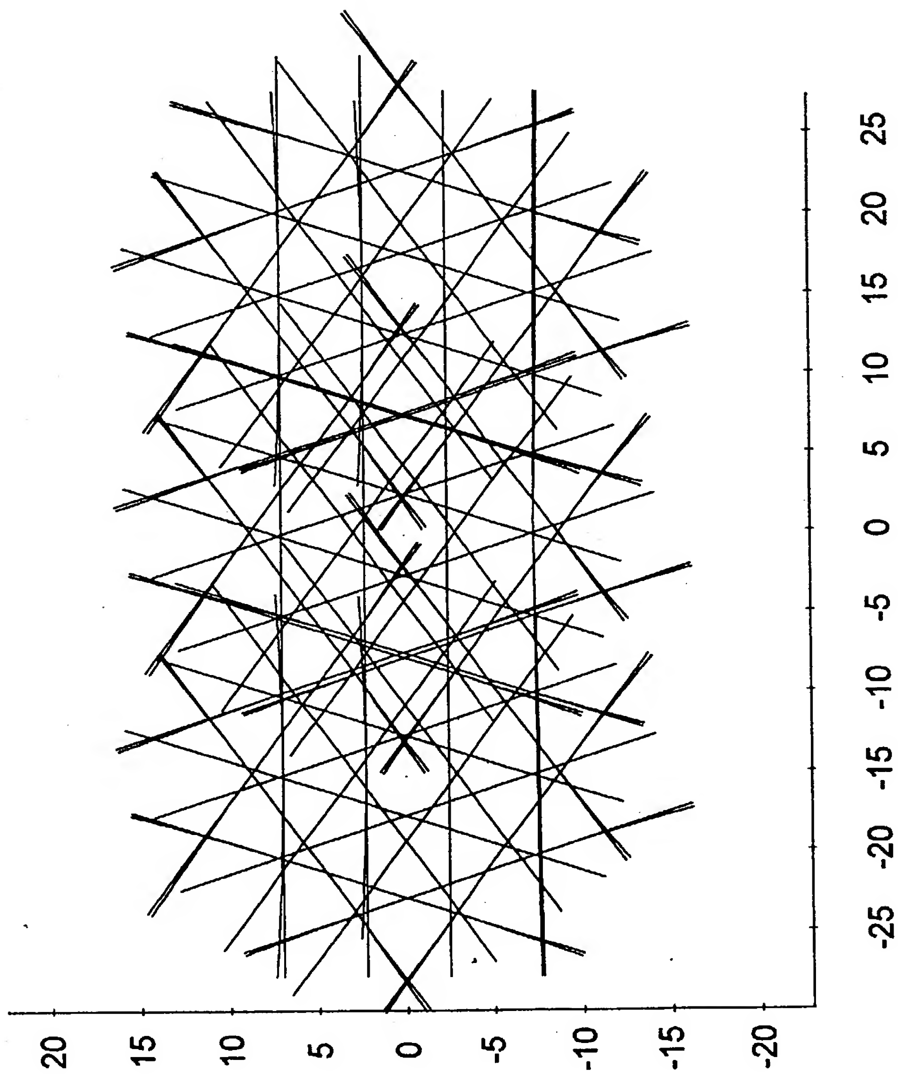


FIG. 9B

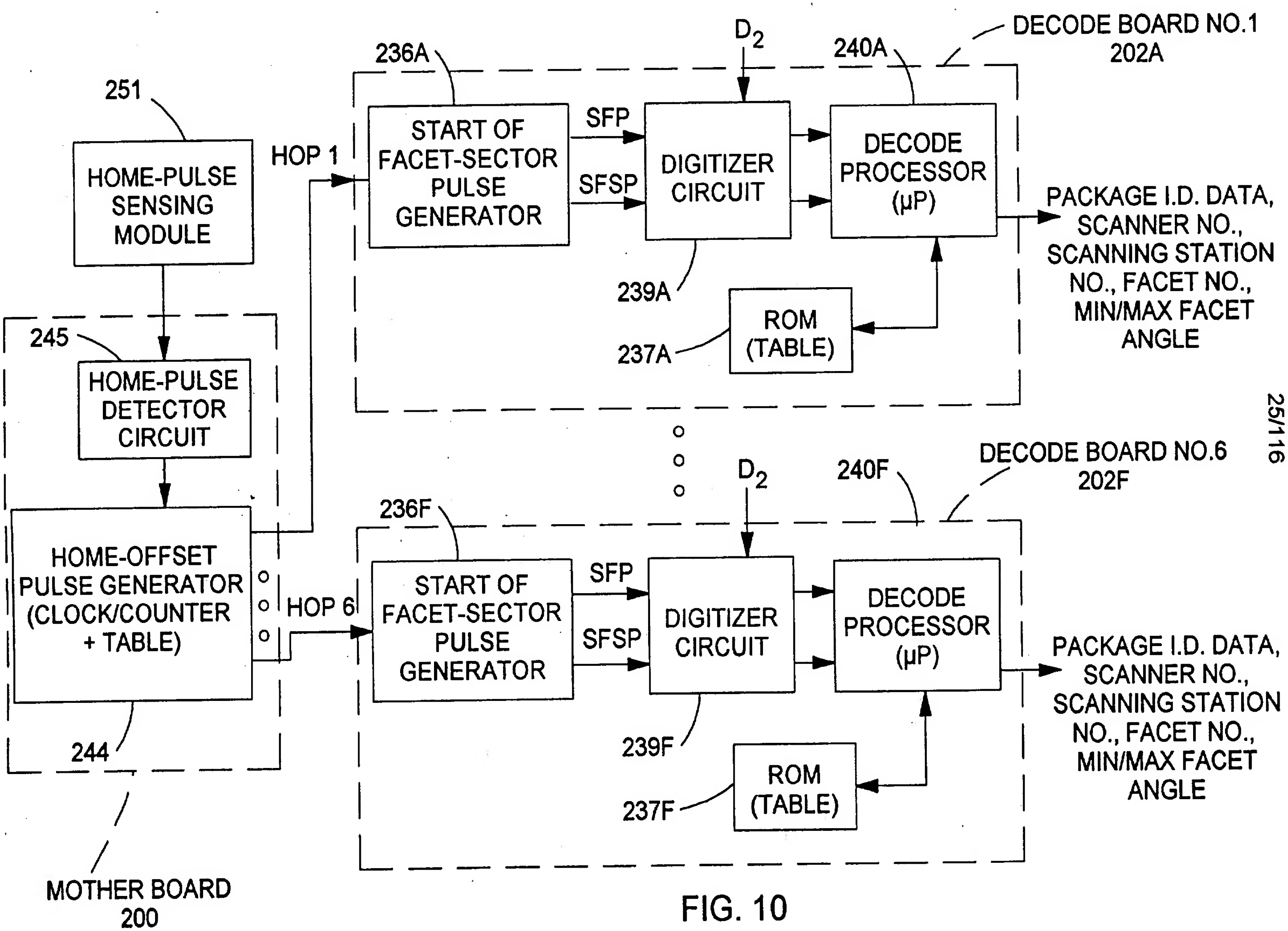

HOME-PULSE SENSING MODULE
251
245
HOME-PULSE DETECTOR CIRCUIT
HOME-OFFSET PULSE GENERATOR (CLOCK/COUNTER + TABLE)
244
MOTHER BOARD 200
HOP 1
HOP 6
236A
START OF FACET-SECTOR PULSE GENERATOR
SFP
SFSP
D_2
DIGITIZER CIRCUIT
239A
240A
DECODE PROCESSOR (μP)
ROM (TABLE)
237A
DECODE BOARD NO.1 202A
PACKAGE I.D. DATA, SCANNER NO., SCANNING STATION NO., FACET NO., MIN/MAX FACET ANGLE
236F
START OF FACET-SECTOR PULSE GENERATOR
SFP
SFSP
D_2
DIGITIZER CIRCUIT
239F
240F
DECODE PROCESSOR (μP)
ROM (TABLE)
237F
DECODE BOARD NO.6 202F
PACKAGE I.D. DATA, SCANNER NO., SCANNING STATION NO., FACET NO., MIN/MAX FACET ANGLE

FIG. 10

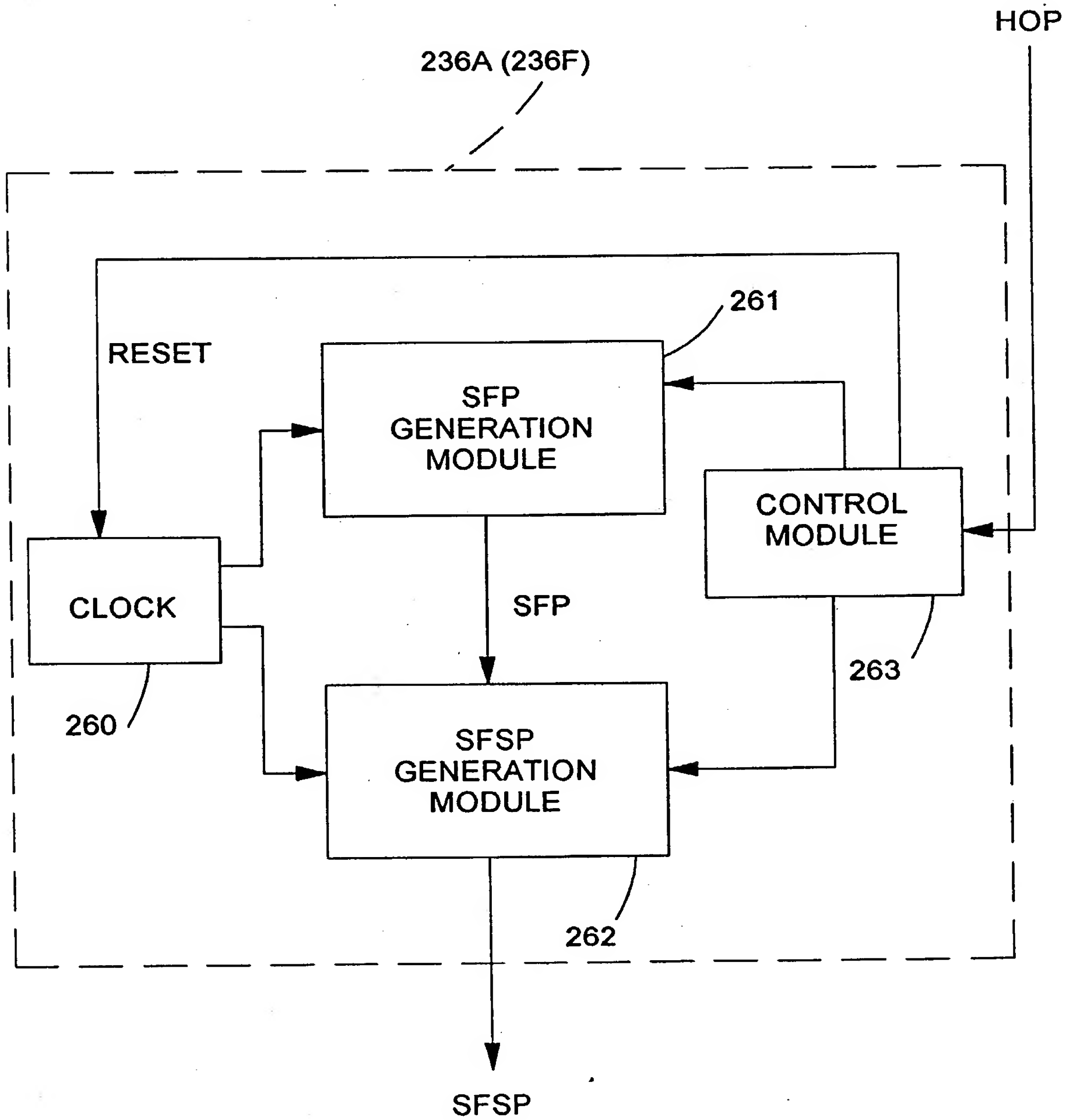

HOP
236A (236F)
261
RESET
SFP
GENERATION
MODULE
CONTROL
MODULE
CLOCK
SFP
263
260
SFSP
GENERATION
MODULE
262
SFSP

FIG. 10A

DATA TABLE EMBODIED IN SFP GENERATOR ON DECODE PROCESSOR BOARD

SCANNING FACET NO.	TRIGGERING EVENT WHEN THE CLOCK PULSE COUNT ATTAINS THE VALUE EQUAL TO THE COUNT VALUE SET FORTH BELOW	PULSE EVENT FROM SFP MODULE
12	7	SF12P
16	146	SF16P
4	271	SF4P
20	4467	SF20P
8	561	SF8P
11	716	SF11P
15	855	SF15P
3	980	SF3P
19	1155	SF19P
7	1270	SF7P
10	1425	SF10P
14	1564	SF14P
2	1689	SF2P
18	1864	SF18P
6	1979	SF6P
9	2134	SF9P
13	2273	SF13P
1	2398	SF1P
17	2573	SF17P
5	2688	SF5P

W = 5200 RPM
CLOCK PULSE WIDTH = 4 μSEC

FIG. 10B

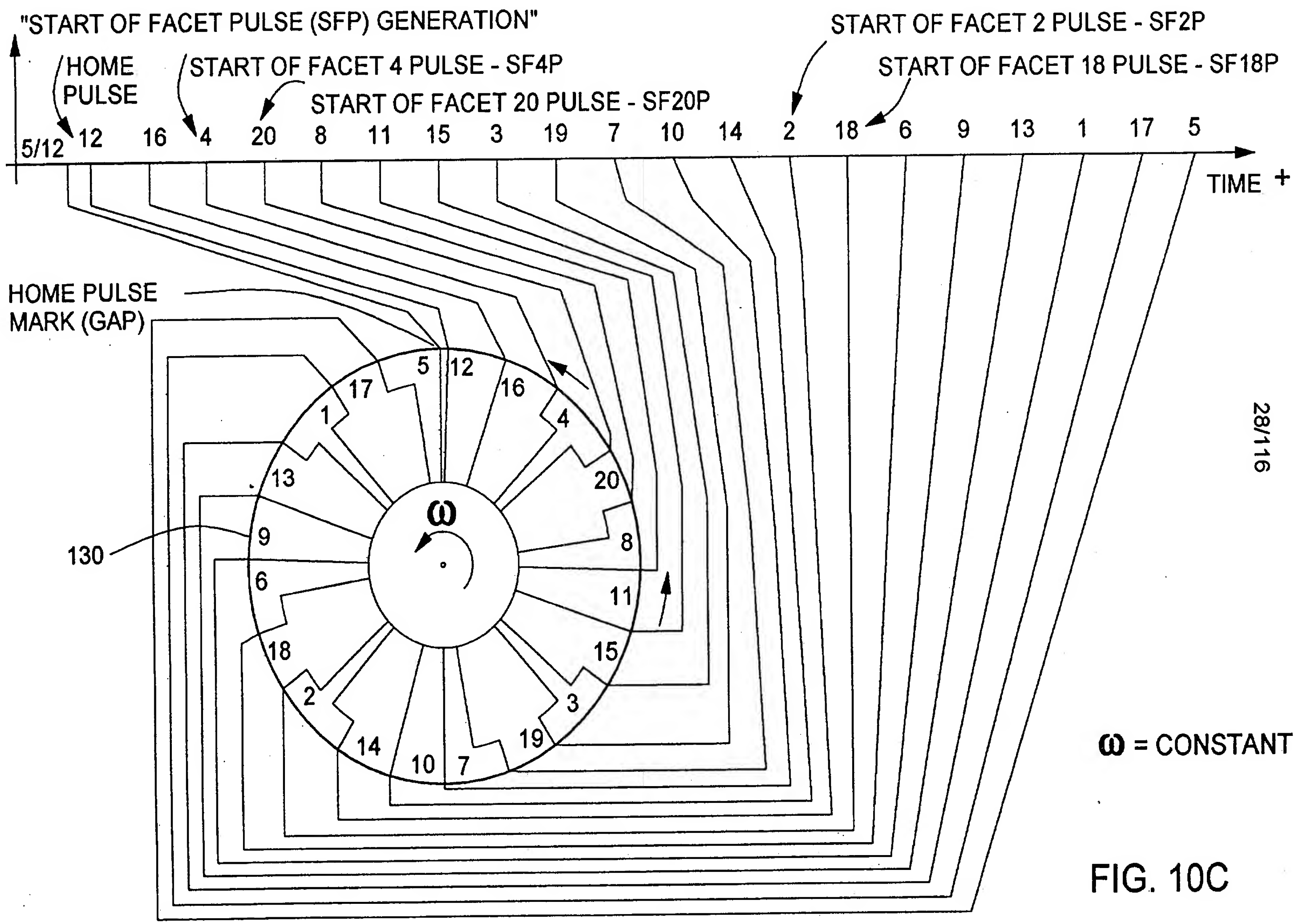

"START OF FACET PULSE (SFP) GENERATION"
HOME PULSE
START OF FACET 4 PULSE - SF4P
START OF FACET 20 PULSE - SF20P
START OF FACET 2 PULSE - SF2P
START OF FACET 18 PULSE - SF18P
5/12 12 16 4 20 8 11 15 3 19 7 10 14 2 18 6 9 13 1 17 5
TIME +
HOME PULSE MARK (GAP)
130
ω
ω = CONSTANT

FIG. 10C

TABLE EMBODIED IN SFSP GENERATOR DECODE PROCESSOR BOARD

SCANNING FACET NO.	SFSP TRIGGERING EVENT	PULSE EVENT FROM SFSP MODULE .
12	RULES 1 - 4 IN FIGS.	SFSP 12/1P SFSP 12/2P SFSP 12/3P SFSP 12/4P
16	RULES 1 - 4 IN FIGS.	SFSP 16/1P SFSP 16/2P SFSP 16/3P SFSP 16/4P
4	RULES 1 - 4 IN FIGS.	SFSP 4/1P SFSP 4/2P SFSP 4/3P SFSP 4/4P
20	RULES 1 - 4 IN FIGS.	SFSP 20/1P SFSP 20/2P SFSP 20/3P SFSP 20/4P
8	RULES 1 - 4 IN FIGS.	SFSP 8/1P SFSP 8/2P SFSP 8/3P SFSP 8/4P
11	RULES 1 - 4 IN FIGS.	SFSP 11/1P SFSP 11/2P SFSP 11/3P SFSP 11/4P
	o o o	
17	RULES 1 - 4 IN FIGS.	SFSP 17/1P SFSP 17/2P SFSP 17/3P SFSP 17/4P
5	RULES 1 - 4 IN FIGS.	SFSP 5/1P SFSP 5/2P SFSP 5/3P SFSP 5/4P

FIG. 10D

RULE 1: FOR GENERATING SFSP/1P TYPE PULSES

FOR EACH FACET X BEFORE WHICH IS LOCATED FACET X-1 AND BEYOND WHICH IS LOCATED FACET X+1 (ABOUT THE SCANNING DISC), THE SFSP GENERATION MODULE GENERATES SFSX/1P TYPE PULSES WHEN THE COUNT IS EQUAL TO:

COUNT (SFSP)

RULE 2: FOR GENERATING SFSX/2P TYPE PULSES

FOR EACH FACET X BEFORE WHICH IS LOCATED FACET X-1 AND BEYOND WHICH IS LOCATED FACET X+1 (ABOUT THE SCANNING DISC), THE SFSP GENERATION MODULE GENERATES SFSX/2P TYPE PULSES WHEN THE COUNT IS EQUAL TO:

$$\text{COUNT (SFSP)} + 1 \left[\frac{\text{COUNT (SFX+1P)} - \text{COUNT (SFXP)}}{4} \right]$$

FIG. 10E1

RULE 3: FOR GENERATING SFSP/3P TYPE PULSES

FOR EACH FACET X BEFORE WHICH IS LOCATED FACET X-1 AND BEYOND WHICH IS LOCATED FACET X+1 (ABOUT THE SCANNING DISC), THE SFSP GENERATION MODULE GENERATES
SFSX/3 TYPE PULSES WHEN THE COUNT IS EQUAL TO:

$$\text{COUNT (SFSP)} + 2\left[\frac{\text{COUNT (SFX+1P)} - \text{COUNT (SFXP)}}{4}\right]$$

RULE4: FOR GENERATING SFSX/4P TYPE PULSES

FOR EACH FACET X BEFORE WHICH IS LOCATED FACET X-1 AND BEYOND WHICH IS LOCATED FACET X+1 (ABOUT THE SCANNING DISC), THE SFSP GENERATION MODULE GENERATES
SFSX/4 TYPE PULSES WHEN THE COUNT IS EQUAL TO:

$$\text{COUNT (SFSP)} + 3\left[\frac{\text{COUNT (SFX+1P)} - \text{COUNT (SFXP)}}{4}\right]$$

FIG. 10E2

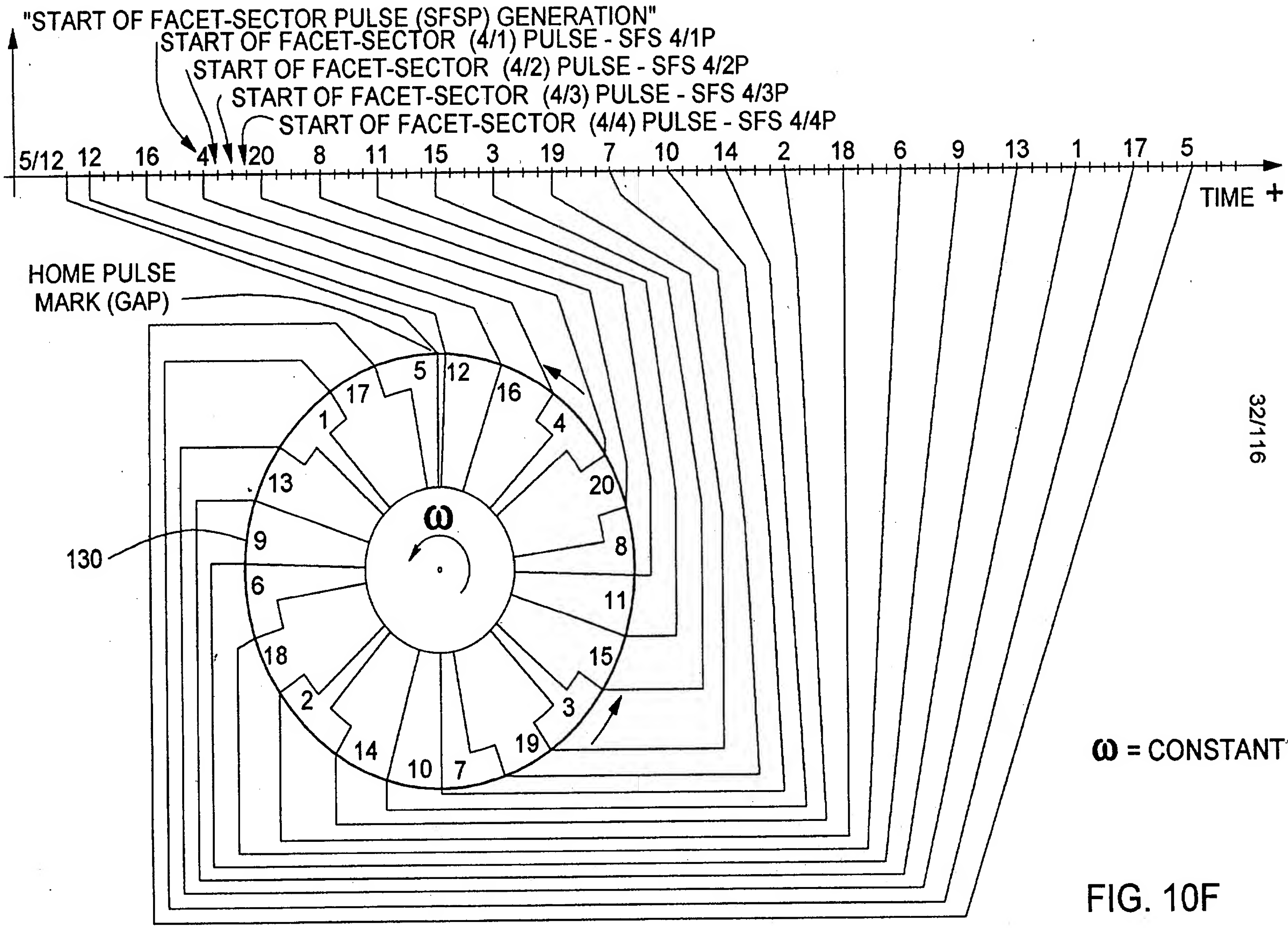

"START OF FACET-SECTOR PULSE (SFSP) GENERATION"
START OF FACET-SECTOR (4/1) PULSE - SFS 4/1P
START OF FACET-SECTOR (4/2) PULSE - SFS 4/2P
START OF FACET-SECTOR (4/3) PULSE - SFS 4/3P
START OF FACET-SECTOR (4/4) PULSE - SFS 4/4P
5/12 12 16 4 20 8 11 15 3 19 7 10 14 2 18 6 9 13 1 17 5
TIME +
HOME PULSE MARK (GAP)
130
ω
5 12 16 4 20 8 11 15 3 19 7 10 14 2 18 6 9 13 1 17
ω = CONSTANT

FIG. 10F

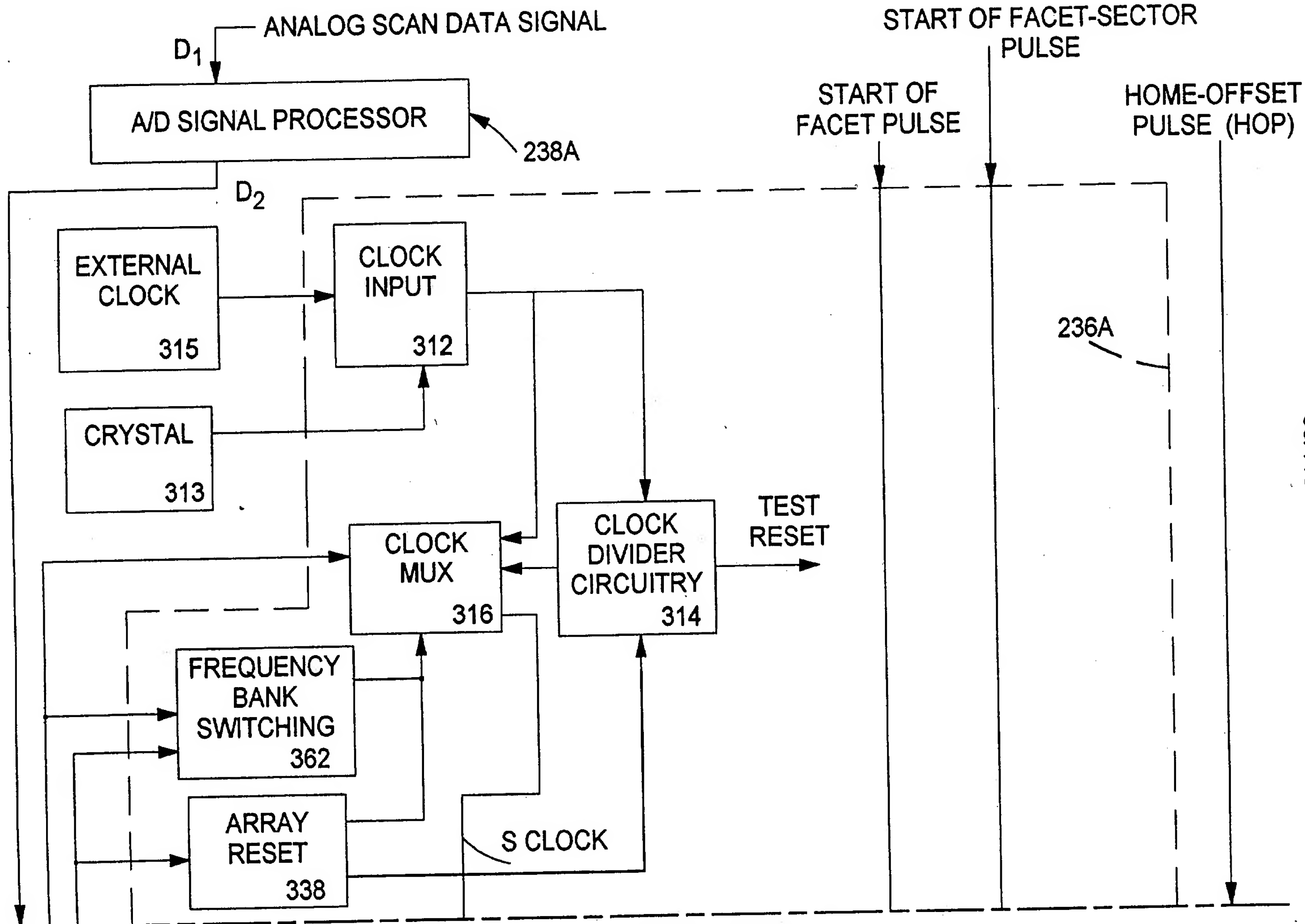
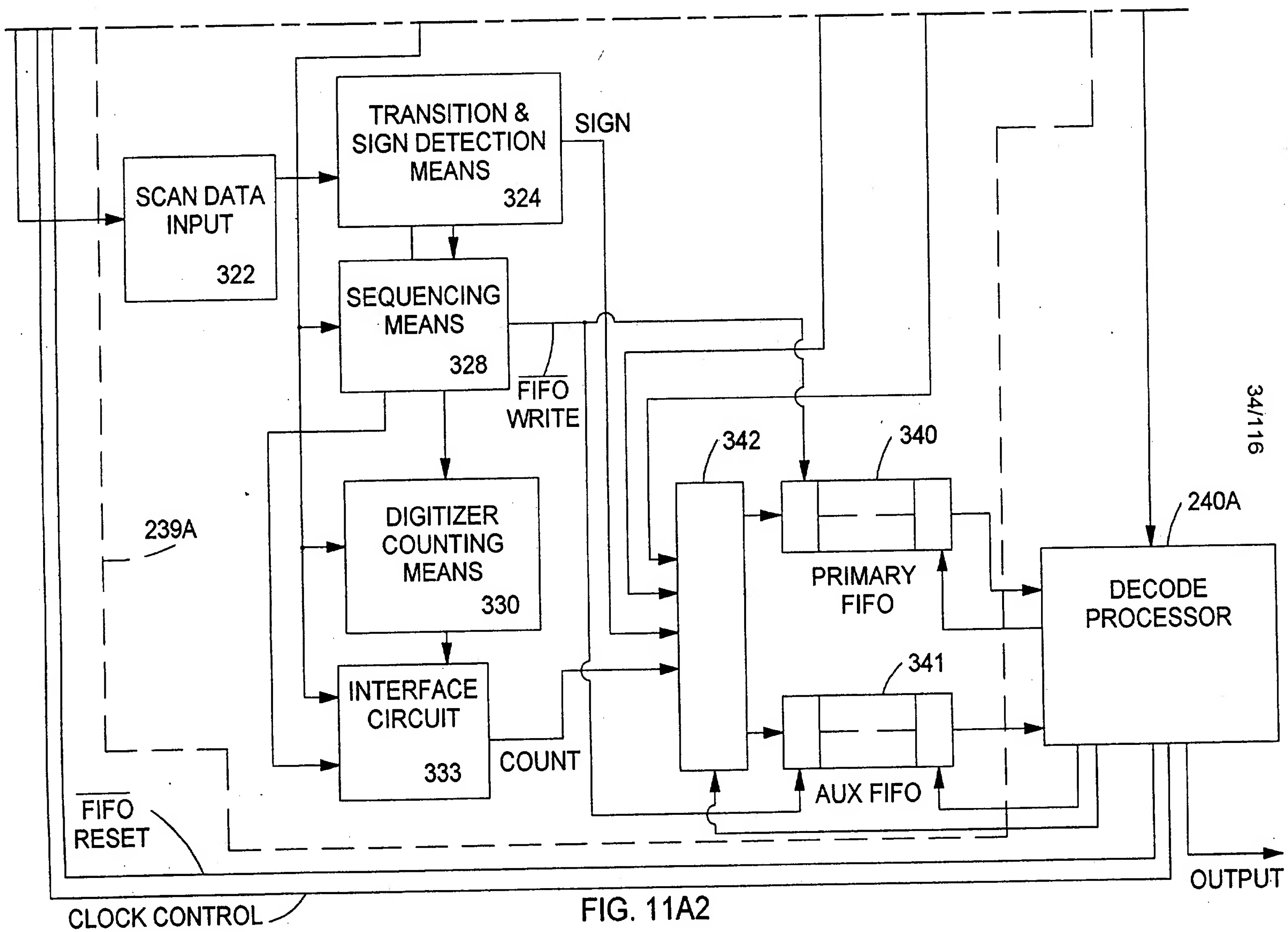

ANALOG SCAN DATA SIGNAL
D1
A/D SIGNAL PROCESSOR
238A
D2
EXTERNAL CLOCK 315
CLOCK INPUT 312
CRYSTAL 313
CLOCK MUX 316
CLOCK DIVIDER CIRCUITRY 314
TEST RESET
FREQUENCY BANK SWITCHING 362
ARRAY RESET 338
S CLOCK
START OF FACET-SECTOR PULSE
START OF FACET PULSE
HOME-OFFSET PULSE (HOP)
236A

FIG. 11A1



SCAN DATA INPUT
322
TRANSITION & SIGN DETECTION MEANS
324
SIGN
SEQUENCING MEANS
328
FIFO WRITE
DIGITIZER COUNTING MEANS
330
INTERFACE CIRCUIT
333
COUNT
342
340
PRIMARY FIFO
341
AUX FIFO
240A
DECODE PROCESSOR
OUTPUT
239A
FIFO RESET
CLOCK CONTROL

FIG. 11A2

10/009368

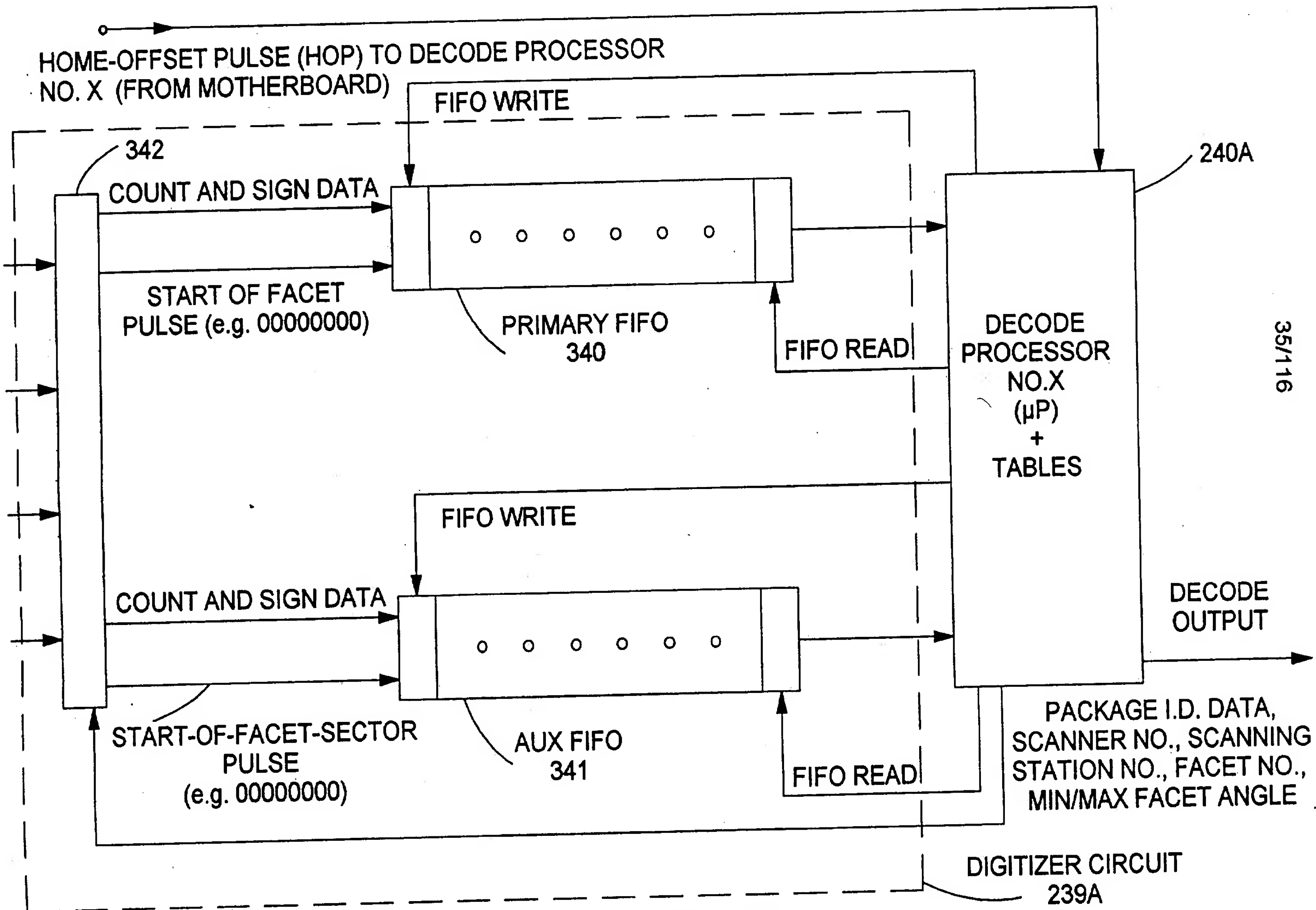


FIG. 11B

SCANNER NO.	TOTAL NO. OF FACETS ON DISC
NO. OF SECTORS / FACET	SCANNING STATION NO.

FIG. 11C1

SCANNING FACET NO.	TRIGGERING EVENT WHEN THE CLOCK PULSE COUNT ATTAINS THE VALUE EQUAL TO THE COUNT VALUE SET FORTH BELOW	PULSE EVENT FROM SFP MODULE
12	7	SF12P
16	146	SF16P
4	271	SF4P
20	4467	SF20P
8	561	SF8P
11	716	SF11P
15	855	SF15P
3	980	SF3P
19	1155	SF19P
7	1270	SF7P
10	1425	SF10P
14	1564	SF14P
2	1689	SF2P
18	1864	SF18P
6	1979	SF6P
9	2134	SF9P
13	2273	SF13P
1	2398	SF1P
17	2573	SF17P
5	2688	SF5P

TABLES EMBODIED IN DECODE PROCESSOR
CLOCK PULSE WIDTH = 4 μSEC
W = 5200 RPM

FIG. 11C2

TABLE EMBODIED IN DECODE PROCESSOR

SCANNING FACET NO.	SFS TRIGGERING EVENT	PULSE EVENT FROM SFSP MODULE .	MINIMUM AND MAXIMUM FACET ANGLES CORRESPONDING TO FACET-SECTOR IDENTIFIED BY SFSP EVENT
12	RULES 1 - 4 IN FIGS.	SFSP 12/1P	θROT MIN, θROT MAX
		SFSP 12/2P	
		SFSP 12/3P	
		SFSP 12/4P	
16	RULES 1 - 4 IN FIGS.	SFSP 16/1P	
		SFSP 16/2P	
		SFSP 16/3P	
		SFSP 16/4P	
4	RULES 1 - 4 IN FIGS.	SFSP 4/1P	
		SFSP 4/2P	
		SFSP 4/3P	
		SFSP 4/4P	
20	RULES 1 - 4 IN FIGS.	SFSP 20/1P	
		SFSP 20/2P	
		SFSP 20/3P	
		SFSP 20/4P	
8	RULES 1 - 4 IN FIGS.	SFSP 8/1P	
		SFSP 8/2P	
		SFSP 8/3P	
		SFSP 8/4P	
11	RULES 1 - 4 IN FIGS.	SFSP 11/1P	
		SFSP 11/2P	
		SFSP 11/3P	
		SFSP 11/4P	
○○○			
17	RULES 1 - 4 IN FIGS.	SFSP 17/1P	
		SFSP 17/2P	
		SFSP 17/3P	
		SFSP 17/4P	
5	RULES 1 - 4 IN FIGS.	SFSP 5/1P	
		SFSP 5/2P	
		SFSP 5/3P	
		SFSP 5/4P	

FIG. 11D

READ SCAN DATA ELEMENTS OUT OF PRIMARY AND AUXILLARY FIFOs IN DIGITIZING CIRCUIT — A

RECOVER DIGITAL COUNT DATA AND SFSP MARKERS FROM OUTPUT DATA STREAM AND BUFFER SAME — B

PROCESS DIGITAL COUNT DATA TO DECODE SYMBOL CHARACTERS AND PRODUCE PACKAGE I,D. DATA, AND USE SFSP TABLE TO DETERMINE SYNCHRONOUS MIN/MAX FACET ANGLES OF FACET SECTOR ON SCANNING DISC USED TO GENERATE LASER BEAM (SWEEP) SECTOR THAT COLLECTED THE PACKAGED I.D. DATA — C

USE DATA TABLE TO CORRELATE PACKAGE I.D. DATA, SCANNER NO., SCANNING STATION NO., FACET NO., AND MIN/MAX FACET ANGLES OF THE FACET SECTOR — D

PRODUCE AS OUTPUT: PACKAGE I.D. DATA, SCANNER NO., SCANNING STATION NO., FACET NO., AND MIN/MAX FACET ANGLES OF THE FACET SECTOR USED TO GENERATE LASER SCANNNNG PLANE THAT COLLECTED PACKAGE I.D. DATA — E

FIG. 11E

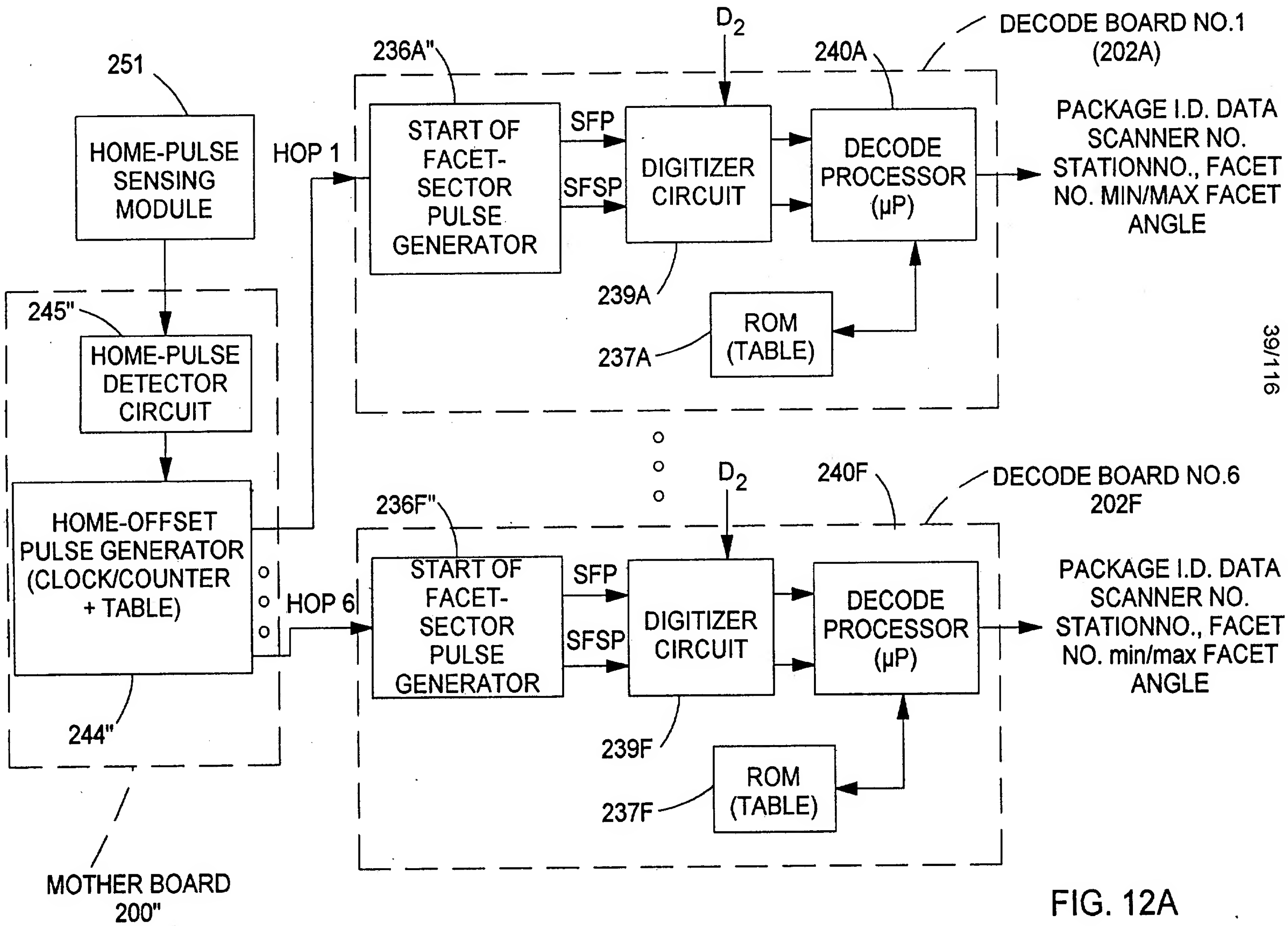

251
HOME-PULSE SENSING MODULE
245"
HOME-PULSE DETECTOR CIRCUIT
HOME-OFFSET PULSE GENERATOR (CLOCK/COUNTER + TABLE)
244"
MOTHER BOARD 200"
HOP 1
HOP 6
236A"
START OF FACET-SECTOR PULSE GENERATOR
SFP
SFSP
D_2
DIGITIZER CIRCUIT
239A
240A
DECODE PROCESSOR (μP)
ROM (TABLE)
237A
DECODE BOARD NO.1 (202A)
PACKAGE I.D. DATA SCANNER NO. STATIONNO., FACET NO. MIN/MAX FACET ANGLE
236F"
START OF FACET-SECTOR PULSE GENERATOR
SFP
SFSP
D_2
DIGITIZER CIRCUIT
239F
240F
DECODE PROCESSOR (μP)
ROM (TABLE)
237F
DECODE BOARD NO.6 202F
PACKAGE I.D. DATA SCANNER NO. STATIONNO., FACET NO. min/max FACET ANGLE

FIG. 12A

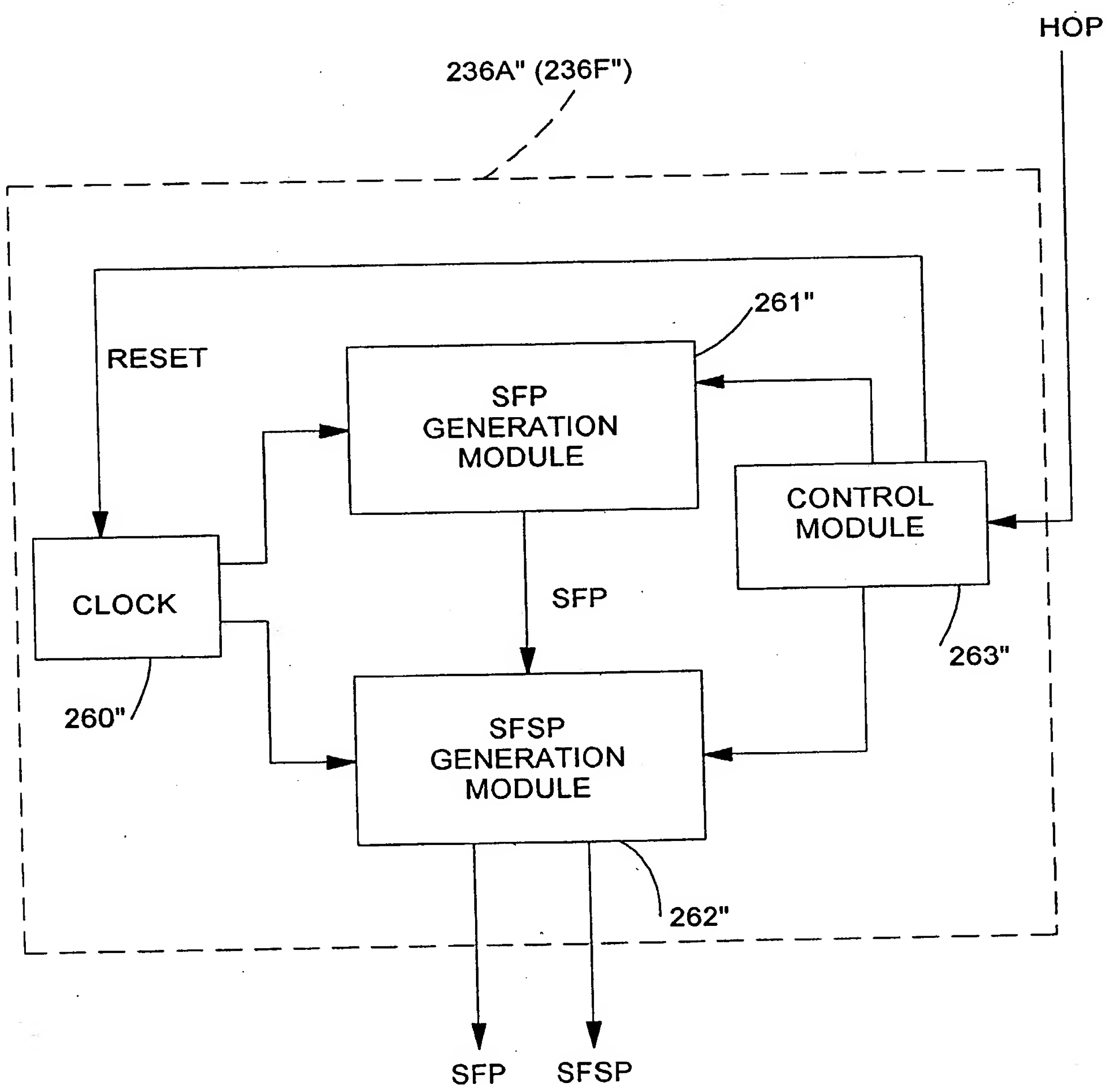
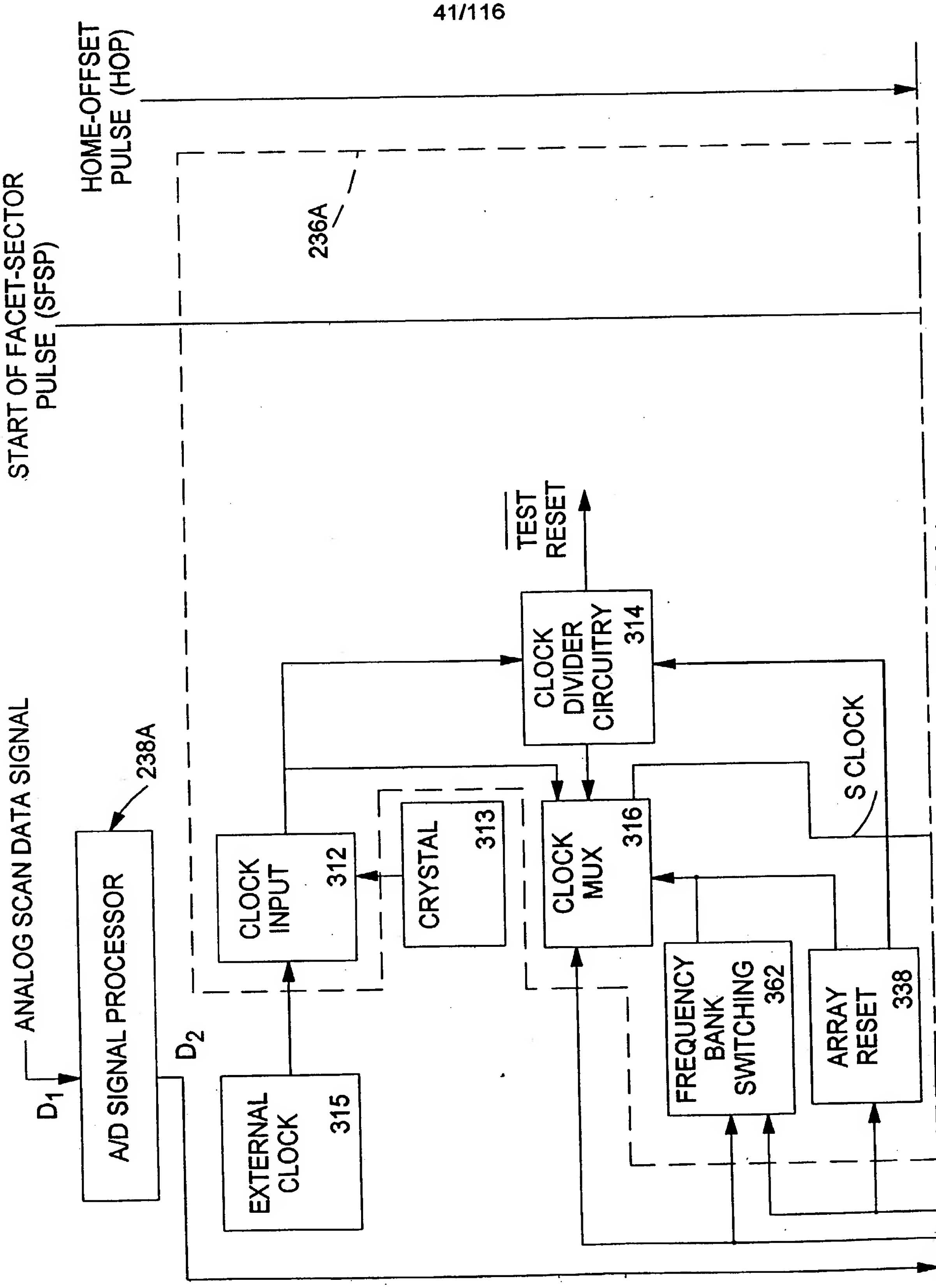

HOP
236A" (236F")
RESET
261"
SFP
GENERATION
MODULE
CONTROL
MODULE
CLOCK
SFP
263"
260"
SFSP
GENERATION
MODULE
262"
SFP
SFSP

FIG. 12B



HOME-OFFSET PULSE (HOP)
START OF FACET-SECTOR PULSE (SFSP)
236A
TEST RESET
CLOCK DIVIDER CIRCUITRY 314
ANALOG SCAN DATA SIGNAL
238A
A/D SIGNAL PROCESSOR
D_1
D_2
CLOCK INPUT 312
CRYSTAL 313
CLOCK MUX 316
S CLOCK
EXTERNAL CLOCK 315
FREQUENCY BANK SWITCHING 362
ARRAY RESET 338

FIG. 13A1

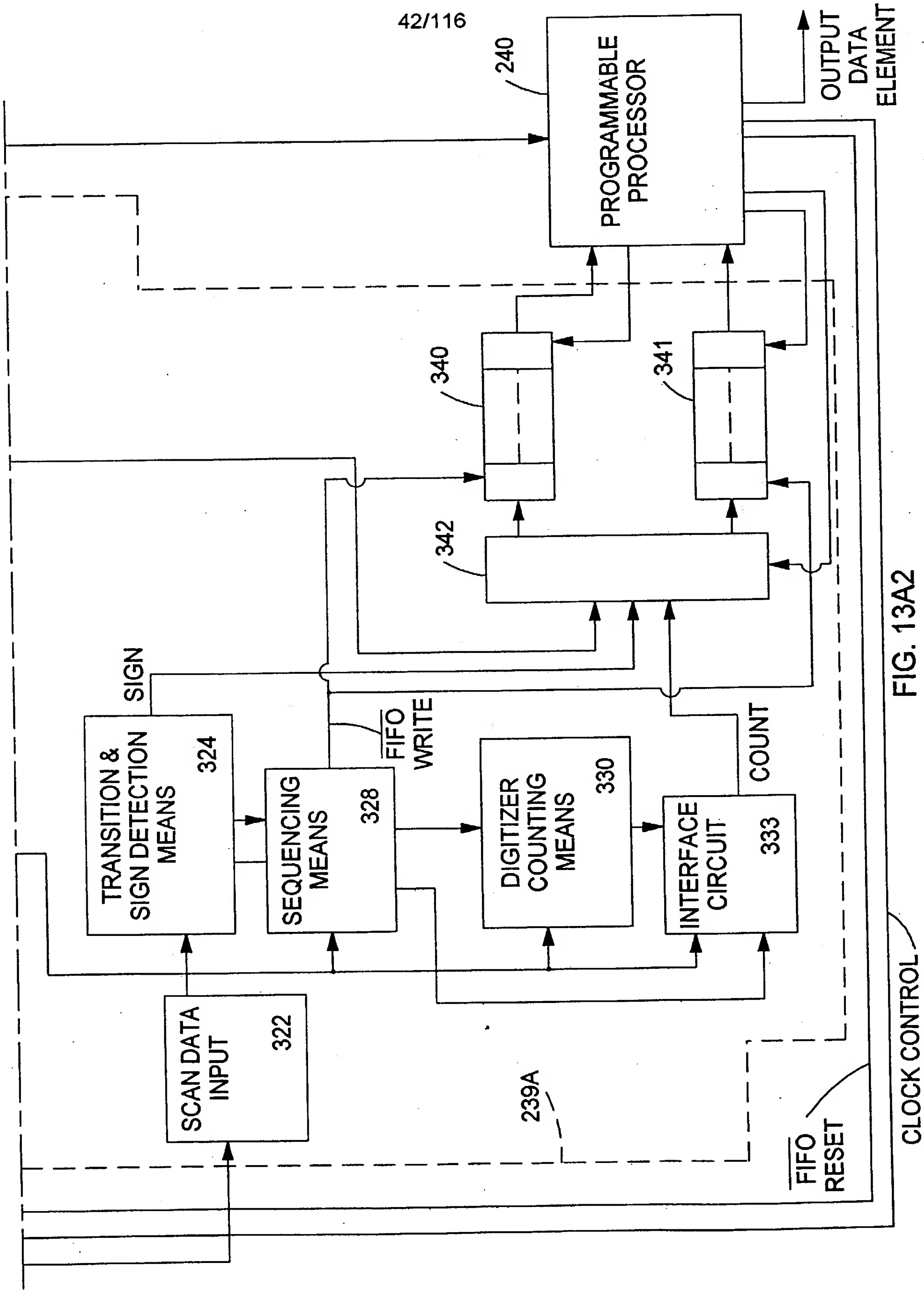

240
PROGRAMMABLE PROCESSOR
OUTPUT DATA ELEMENT
340
341
342
SIGN
TRANSITION & SIGN DETECTION MEANS
324
SEQUENCING MEANS
328
FIFO WRITE
DIGITIZER COUNTING MEANS
330
INTERFACE CIRCUIT
333
COUNT
SCAN DATA INPUT
322
239A
FIFO RESET
CLOCK CONTROL

FIG. 13A2

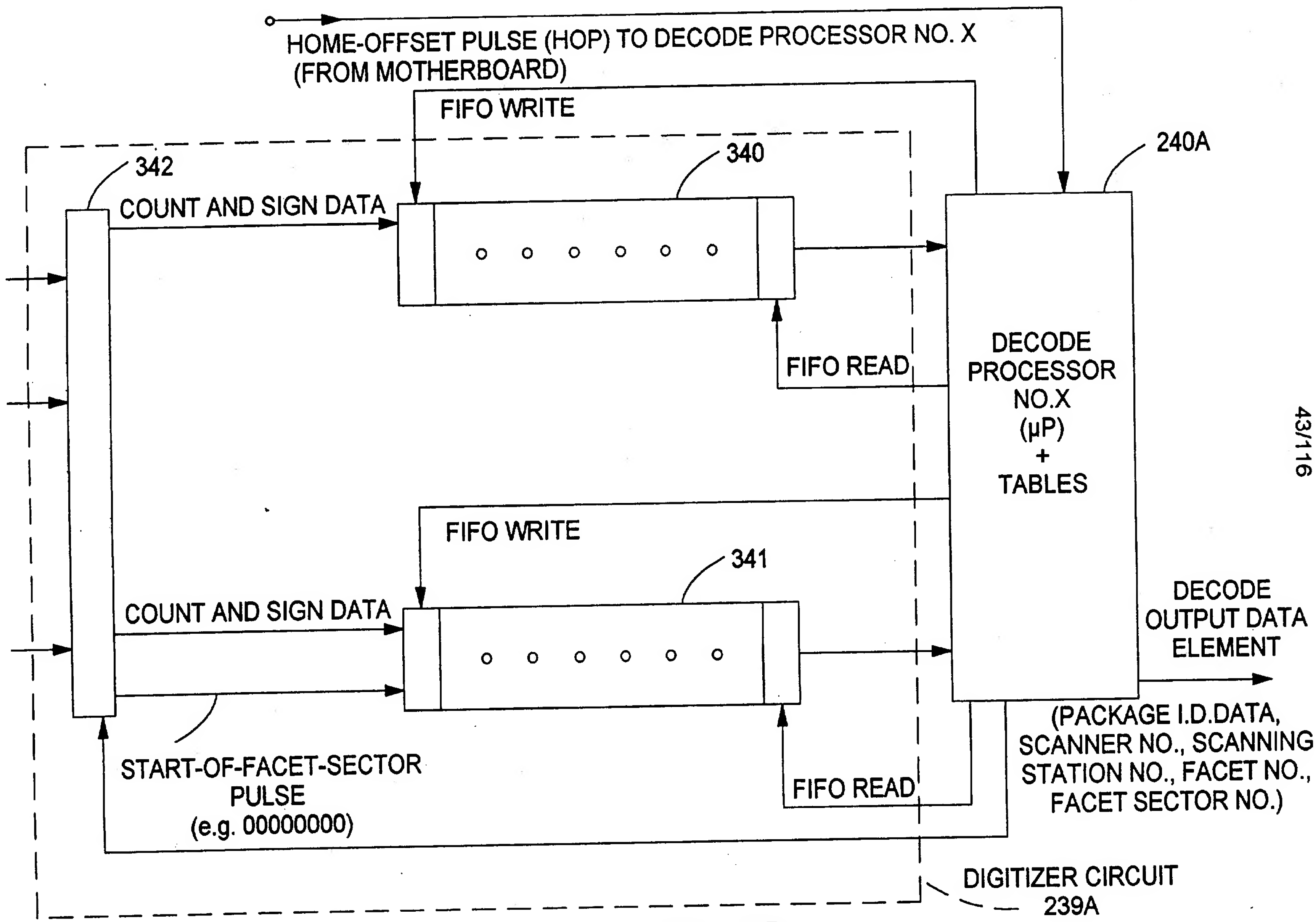

HOME-OFFSET PULSE (HOP) TO DECODE PROCESSOR NO. X
(FROM MOTHERBOARD)
FIFO WRITE
340
240A
342
COUNT AND SIGN DATA
FIFO READ
DECODE
PROCESSOR
NO.X
(µP)
+
TABLES
FIFO WRITE
341
COUNT AND SIGN DATA
DECODE
OUTPUT DATA
ELEMENT
(PACKAGE I.D.DATA,
SCANNER NO., SCANNING
STATION NO., FACET NO.,
FACET SECTOR NO.)
START-OF-FACET-SECTOR
PULSE
(e.g. 00000000)
FIFO READ
DIGITIZER CIRCUIT
239A

FIG. 13B

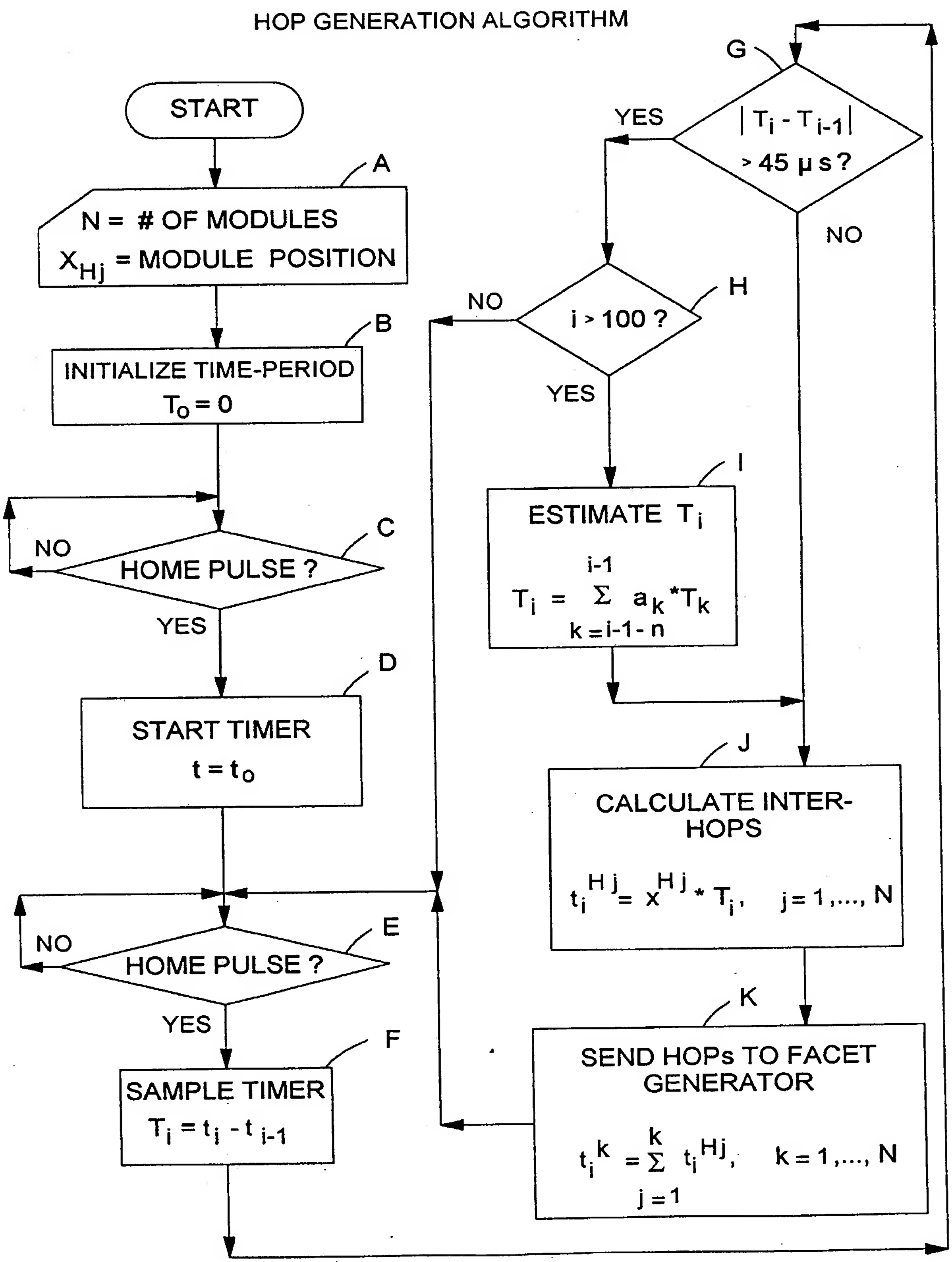

HOP GENERATION ALGORITHM
START
A
N = # OF MODULES
X_{Hj} = MODULE POSITION
B
INITIALIZE TIME-PERIOD
$T_o = 0$
C
NO
HOME PULSE ?
YES
D
START TIMER
$t = t_o$
E
NO
HOME PULSE ?
YES
F
SAMPLE TIMER
$T_i = t_i - t_{i-1}$
G
$|T_i - T_{i-1}| > 45\ \mu s$?
YES
NO
H
$i > 100$?
NO
YES
I
ESTIMATE T_i
$T_i = \sum_{k=i-1-n}^{i-1} a_k * T_k$
J
CALCULATE INTER-HOPS
$t_i^{Hj} = x^{Hj} * T_i, \quad j = 1, \ldots, N$
K
SEND HOPs TO FACET GENERATOR
$t_i^k = \sum_{j=1}^{k} t_i^{Hj}, \quad k = 1, \ldots, N$

FIG. 14A

10/009368

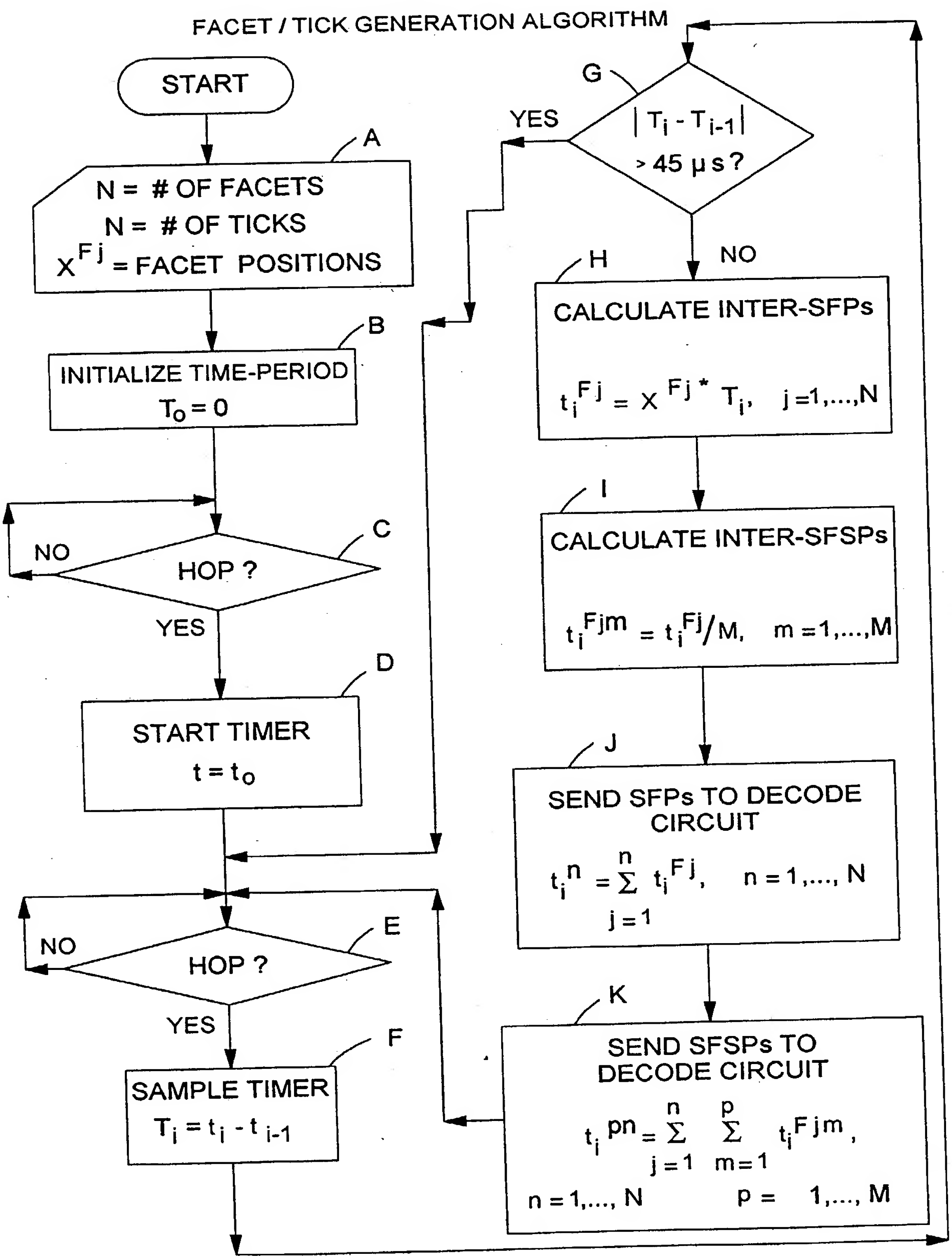


FIG. 14B

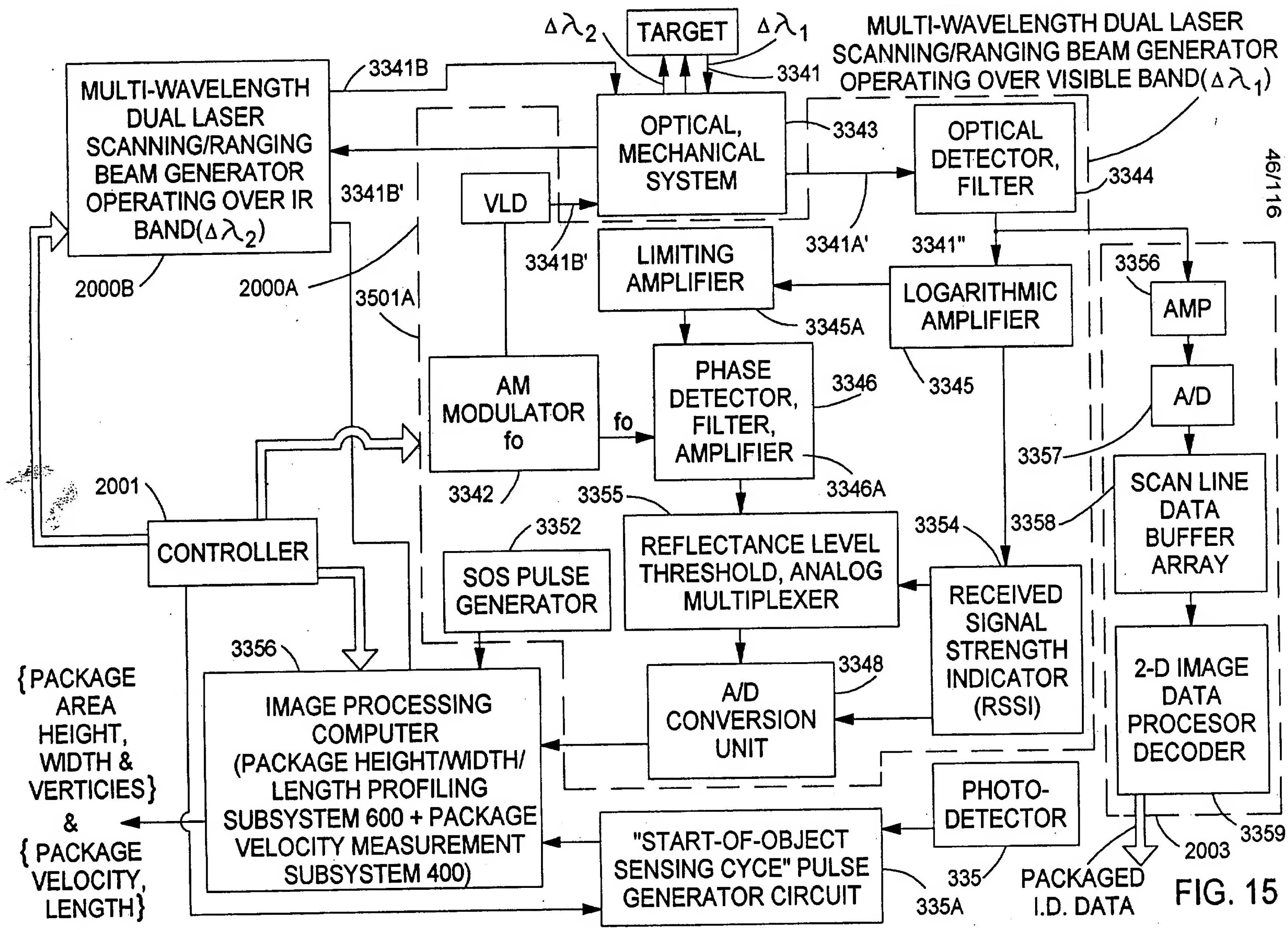


FIG. 15

10/009368

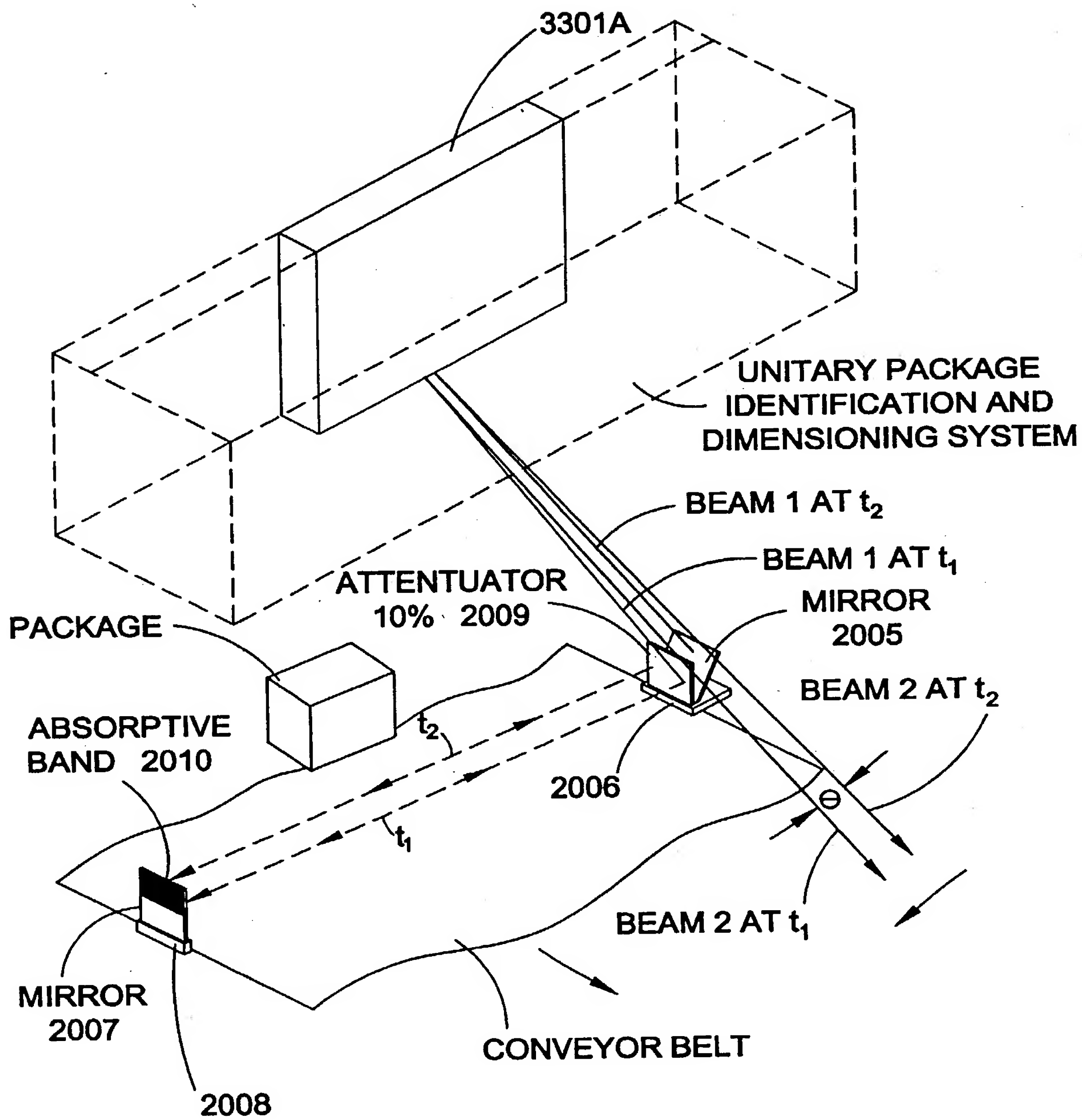

3301A
UNITARY PACKAGE IDENTIFICATION AND DIMENSIONING SYSTEM
BEAM 1 AT t_2
BEAM 1 AT t_1
ATTENTUATOR 10% 2009
MIRROR 2005
PACKAGE
BEAM 2 AT t_2
ABSORPTIVE BAND 2010
t_2
2006
Θ
t_1
BEAM 2 AT t_1
MIRROR 2007
CONVEYOR BELT
2008

FIG. 15A

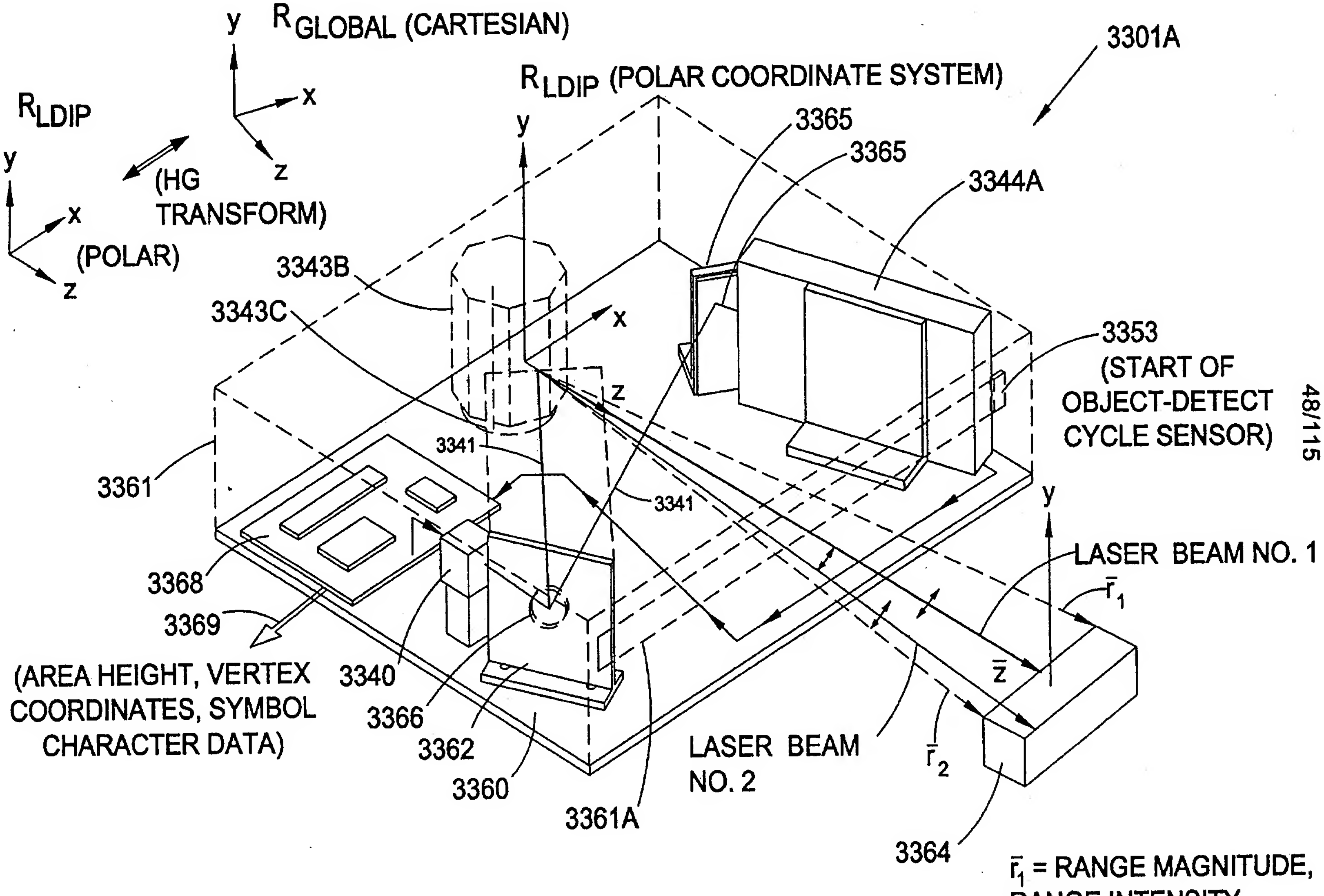

R_{GLOBAL} (CARTESIAN)
y
x
z
R_{LDIP}
(HG
TRANSFORM)
(POLAR)
R_{LDIP} (POLAR COORDINATE SYSTEM)
3301A
3365
3365
3344A
3343B
3343C
3353
(START OF
OBJECT-DETECT
CYCLE SENSOR)
3341
3341
3361
3368
3369
(AREA HEIGHT, VERTEX
COORDINATES, SYMBOL
CHARACTER DATA)
3340
3366
3362
3360
3361A
LASER BEAM NO. 1
$\bar{r}_1$
$\bar{z}$
$\bar{r}_2$
LASER BEAM
NO. 2
3364
$\bar{r}_1$ = RANGE MAGNITUDE,
RANGE INTENSITY

FIG. 15B

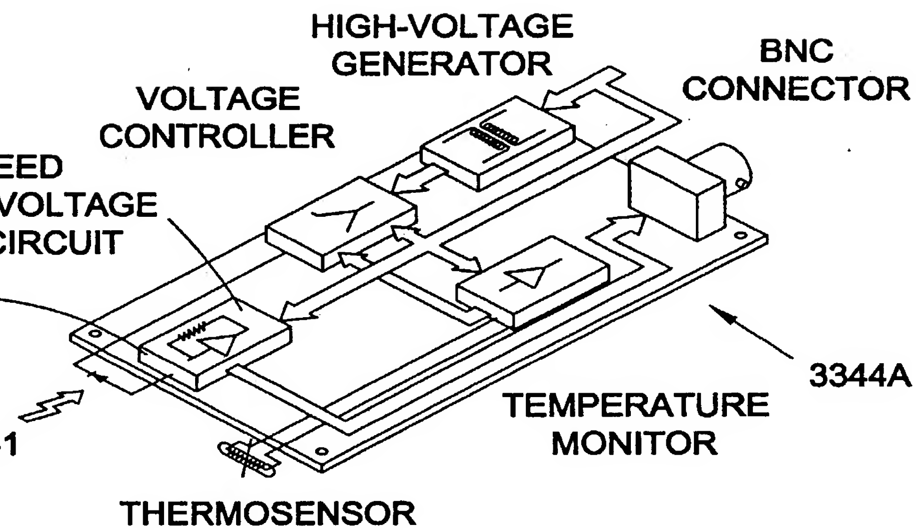


FIG. 15C

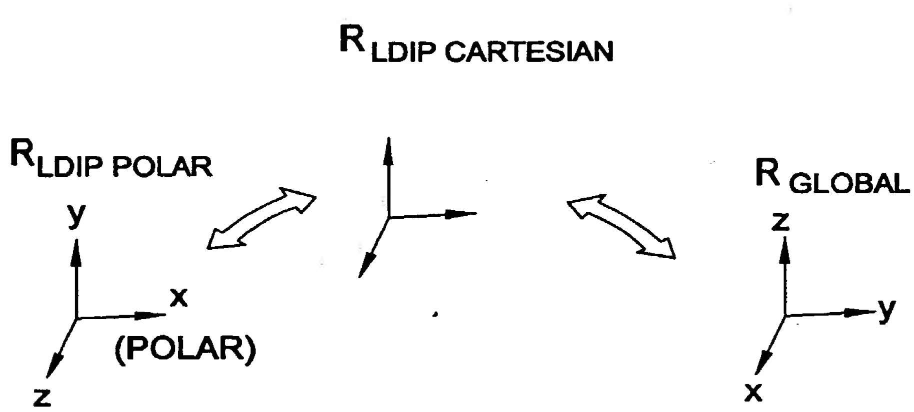


FIG. 15D

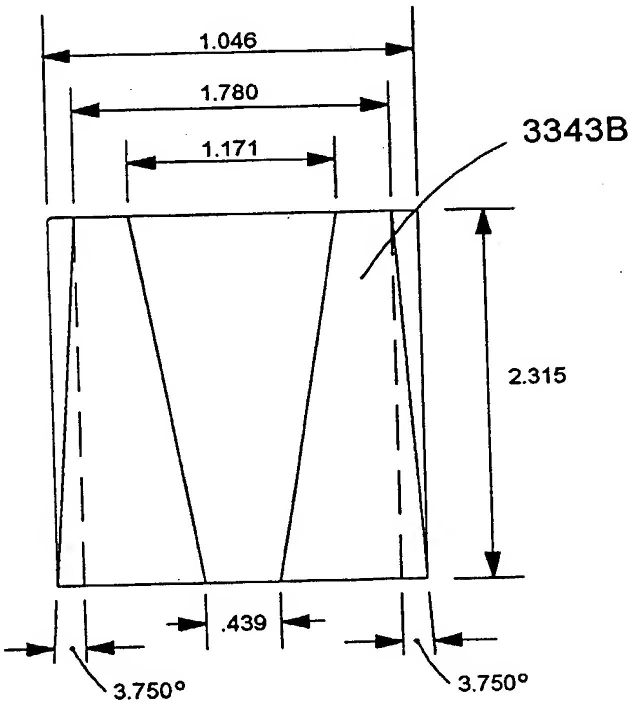


FIG. 15E1

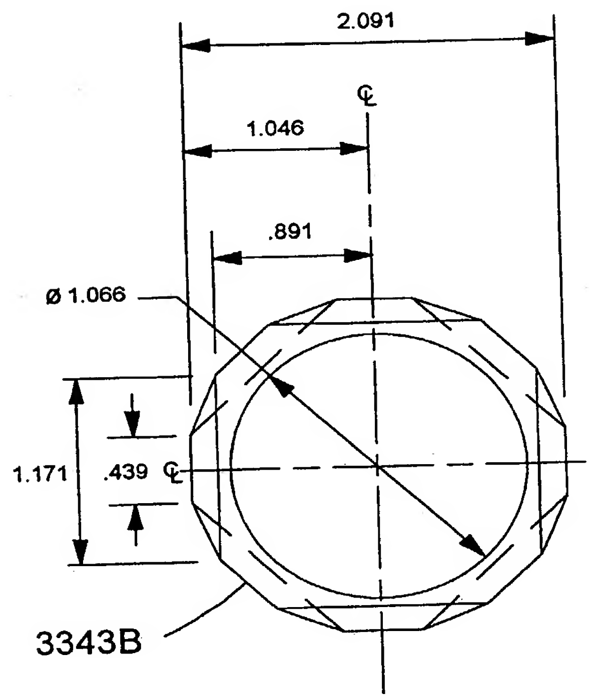


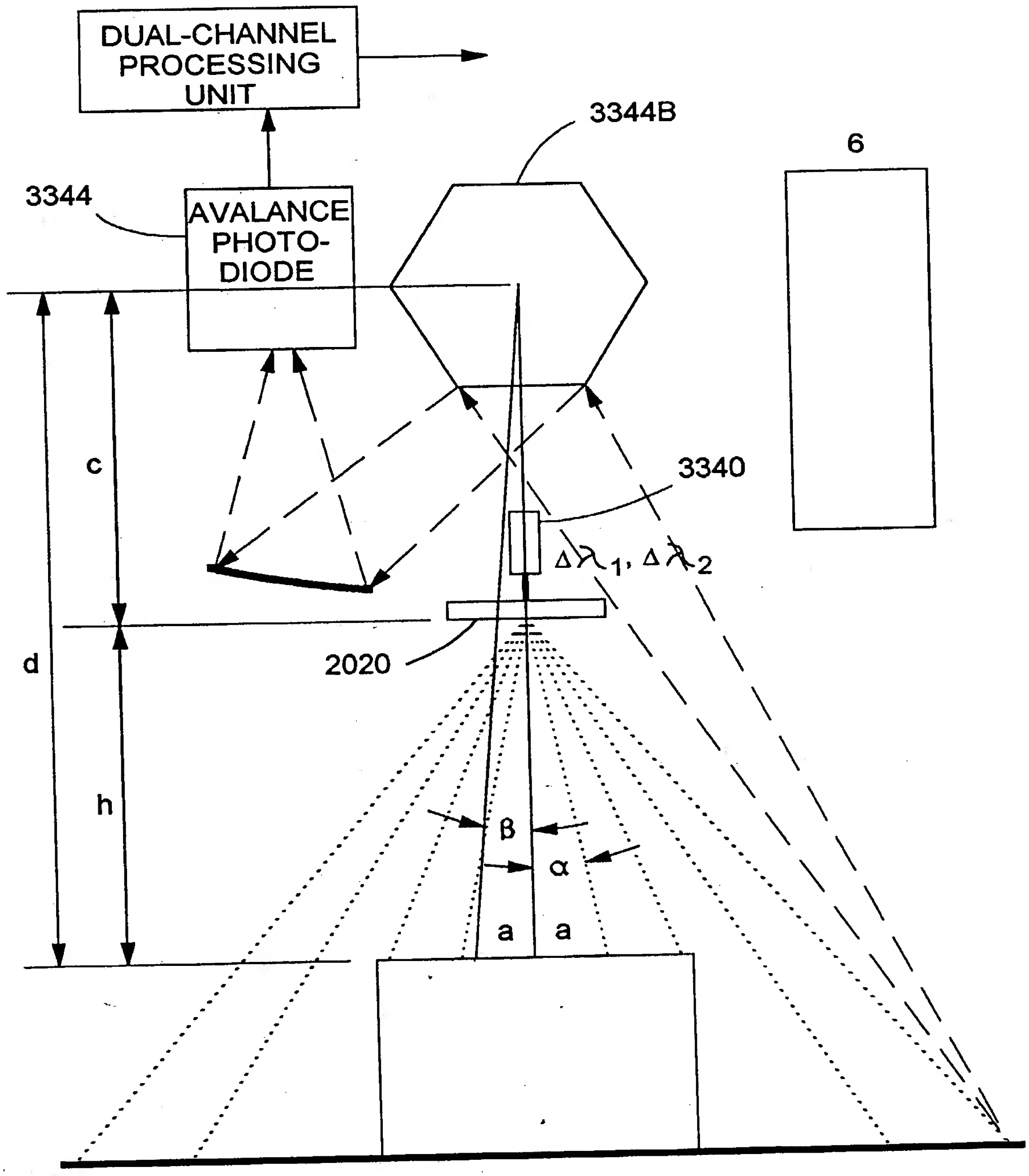
FIG. 15E2

FACE #	ANGLE (DEGREES)
1	3.75
2	-3.75
3	3.75
4	-3.75
5	3.75
6	-3.75
7	3.75
8	-3.75

FIG. 15E3

BEAM NO. 1	1	$\Delta\lambda_1$
	3	$\Delta\lambda_2$
	5	
	7	
BEAM NO. 2	2	$\Delta\lambda_1$
	4	$\Delta\lambda_2$
	6	
	8	

FIG. 15E4



THE EQUATION FOR THE CALCULATION OF THE DISTANCE FROM THE DEVICE TO THE OBJECT:

$a=h \tan\alpha$, $a=d \tan\beta$, $d=h-c$

$h=(c \tan\beta)(\tan\alpha - \tan\beta)$

FIG. 15F

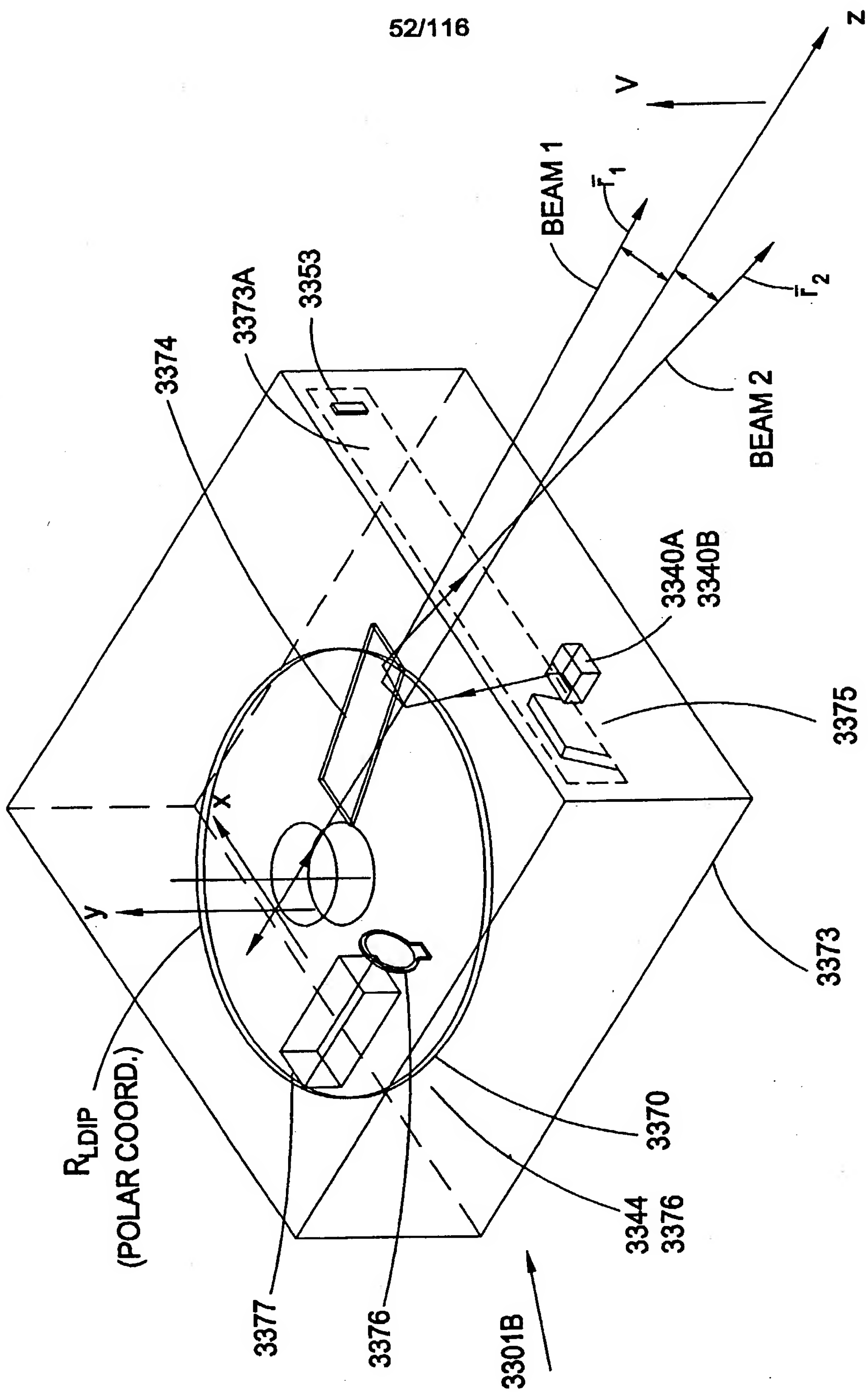

z
V
BEAM 1
$\bar{r}_1$
$\bar{r}_2$
BEAM 2
3374
3373A
3353
3340A
3340B
3375
3373
3370
3344
3376
3377
3376
3301B
x
y
R_{LDIP}
(POLAR COORD.)

FIG. 15G

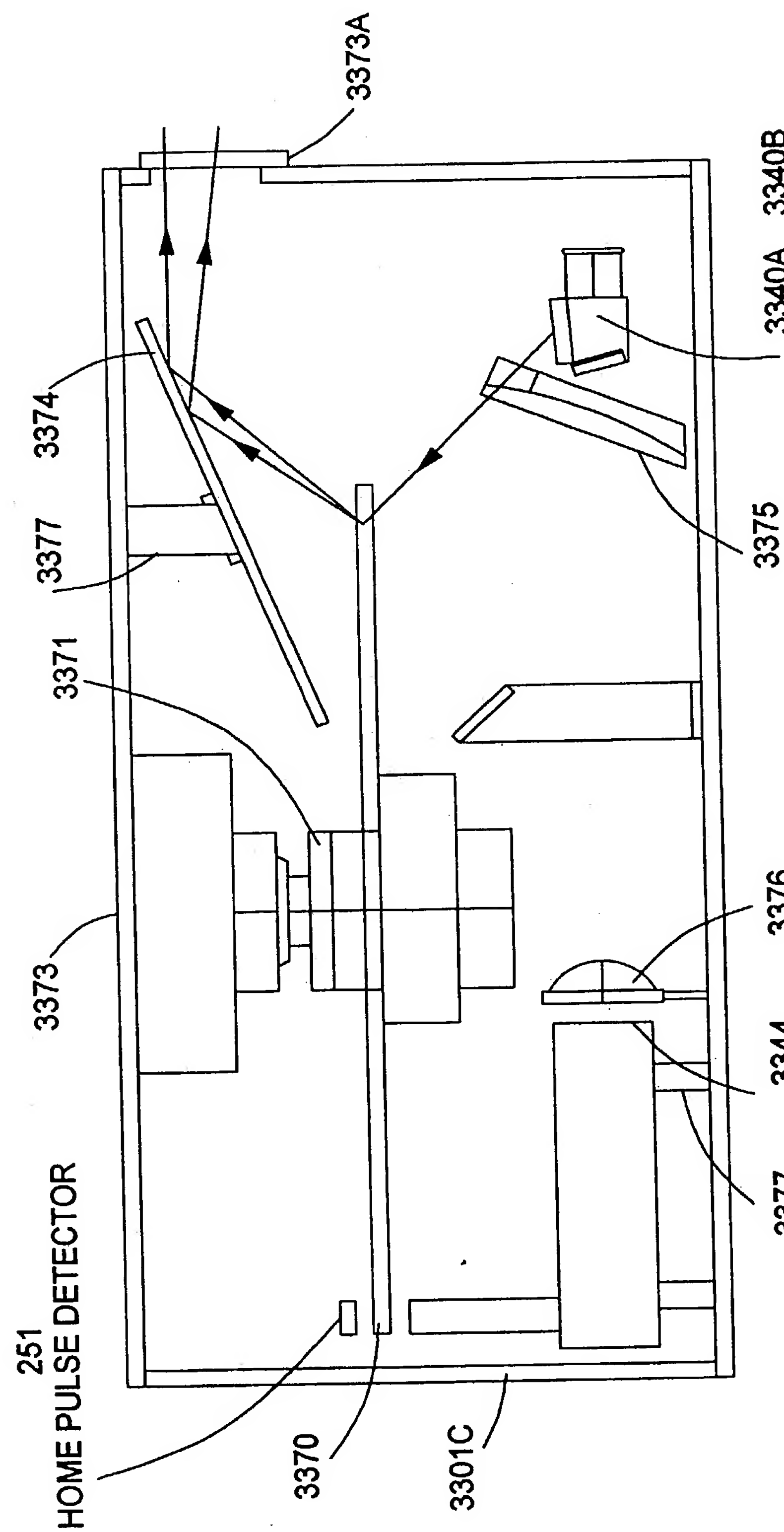

3373A
3340A , 3340B
3374
3377
3375
3371
3376
3373
3344
3377
251
HOME PULSE DETECTOR
3370
3301C

FIG. 15H